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Contents, Page 79

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THE METAL INDUSTRY

WITH WHICH ARE INCORPORATED
THE ALUMINUM WORLD: COPPER AND BRASS: THE BRASS FOUNDER AND FINISHER
ELECTRO-PLATERS REVIEW

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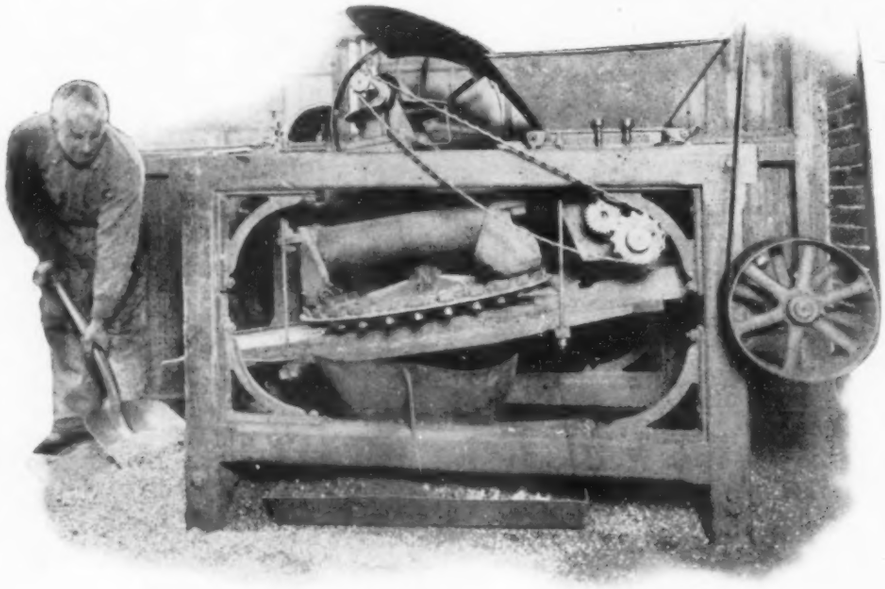

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Vol. 19 NEW YORK, FEBRUARY, 1921 No. 2

The Right Molding Machine

The Essential Features of a Good Molding Machine for the Brass Foundry

Written for The Metal Industry by WILLIAM H. PARRY

The above caption may or may not convey to the reader just how big a job it is even to attempt to describe a molding machine that is best fitted for brass foundry purposes, and as I am mindful of the fact that it is a very easy matter to bite off more than one can chew when tackling such a complex subject, I shall confine myself to a description of those machines that in my own experience have proved to be not only good producers for the brass foundry, but for any other kind of a foundry as well.

At the outset it must be understood that all molding machines have their limitations, in fact, no universal molding machine has yet arrived. Nor do I believe it ever will, in the sense that any one machine can be made to adapt itself to any class of work, and it would be unreasonable on the part of any founder to expect to find such a machine on the market.

As there are various kinds of brass foundries, it naturally follows that a machine suitable to meet the conditions existing in one foundry will not do so at another. Also the attitude and demeanor of the men in charge of brass foundries have considerable bearing on the success or failure of the molding machine installations.

In any brass foundry where production is not a factor, and there are plenty of them, molding machines are a superfluity. The same applies to small jobbing foundries whose orders are not large enough to pay for the necessary pattern mounting incidental to molding machine operation. But for any brass foundry whose aim is production, and the nature of the work is such that it can be readily mounted on molding machines (as a matter of fact, all patterns can be so mounted, no matter how complicated), it would be folly to ignore their possibilities.

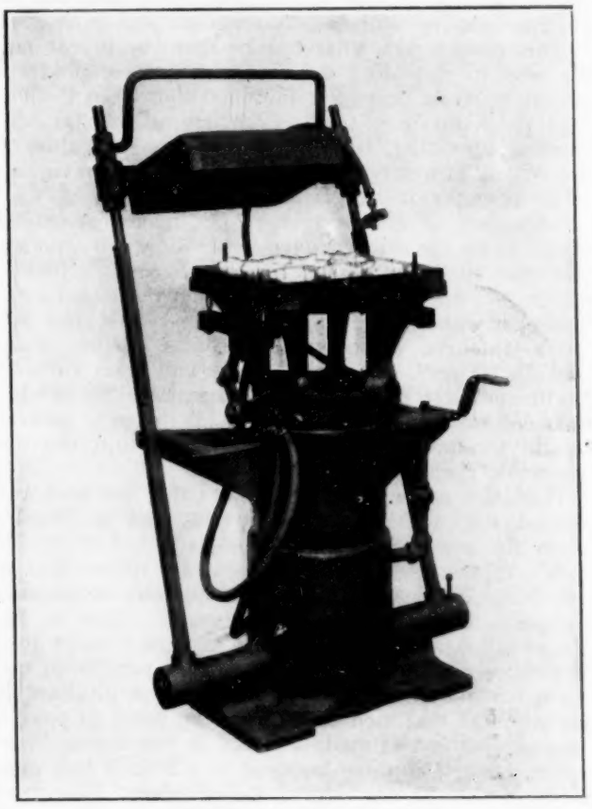
Hand-operated molding machines in a foundry where compressed air or the electric current are conspicuous by their absence, are a great help; in fact, they lend themselves to short run jobs amazingly well.

Such makes as the Turner Machine Company, the Osborn Manufacturing Company and the American Foundry Equipment Company are easily the leaders in manufacturing this type of machine.

THE TURNER MOLDING MACHINE

The Turner type of machine for plumbers' supply work is a splendid tool in a brass foundry. They make them both hand and power operated, and were in the business of manufacturing molding machines before about 95 per cent of the present day crop of manufacturers knew what a molding machine looked like. The possibilities of this machine have never received proper recognition by foundrymen, and it includes features, such as the cope lift, that is advertised by its competitors as something brand new, and only to be found in their make of machine.

I had a rather amusing experience with an alleged



TURNER MOLDING MACHINE

inventor who would insist on trying to sell me his invention, which could be applied to any make of molding machine, and was nothing more or less than the Turner idea for easing off the cope. I suggested that he take a trip to Philadelphia, where Turner holds forth, in the hope that Turner's grandson would kick him for a goal.

THE OSBORN MOLDING MACHINE

The Osborn Manufacturing Company, of Cleveland, Ohio, make a fine line of molding machines, hand and power operated. Their types run from a simple squeezer to a machine that, if equipped with overalls and a jumper, would talk all languages, including Polish, which is going some. There is not any class of work too plain or too complicated for the Osborn line, and to attempt a description of their many makes is beyond my descriptive powers. Suffice it to say that their machines are in operation in more brass foundries in this country than any other make.

Perhaps the adjustable flask stripping machine made by this concern would appeal to many brass founders, as it can be adjusted to a fair range of flask sizes, but their many lines of molding machines, each one embodying some new feature, would interest all brass founders seeking machines to increase production on small, medium and big work.

AMERICAN FOUNDRY EQUIPMENT MOLDING MACHINES

The American Foundry Equipment Company of New York City specialize in hand-operated machines and are, comparatively speaking, newcomers in the business, but, as their make of machines can and do handle heavy work with an ease of operation that is astonishing when you consider that neither compressed air, steam or electricity is used; their line is well worth being considered by brass foundrymen who seek to increase production, but who are handicapped by power restrictions.

This proves just what can be done by inventors, in the way of providing machines to increase production under the worst possible conditions, and, when I tell you that the American F. F. C. machine will jar—ram, squeeze, turn over, and pattern draw molds without the use of any power other than that contained in the body of the operator, it is but a plain statement of fact.

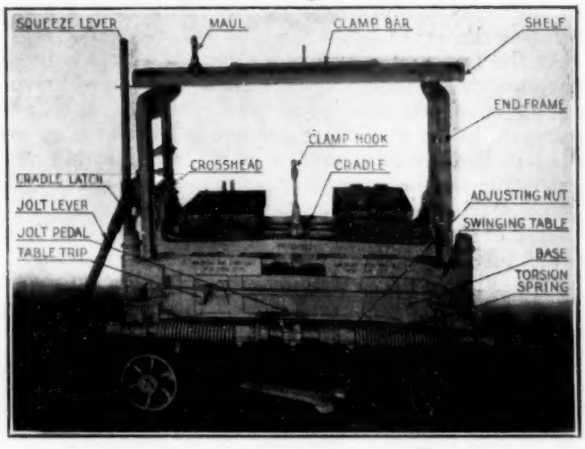
There are of course many other makes of molding machines on the market, some good, some fair, and some bad ones, such, for instance, as one shown at a foundrymen's convention a few years ago, that resembled a river dredge in appearance, and was saddled with steel cable, gears, ratchets, levers, cranks, slides, chains, cranes, buckets, hoppers, conveyors, riddles and other furbelows too numerous to mention, the aggregate weight of which, if loaded on flat cars, would give all the most powerful freight locomotive could do to pull it into the town whence it came.

There are power driven machines that use both compressed air and the electric current, and in foundries where the power bill is one of the least of their troubles, such equipment will fit in. There are others that are belt driven, and use a fairly liberal quantity of illuminating gas to keep the pattern plate warm. Then we have the so-called automatic molding machines made by at least three reputable concerns, and quite capable of turning out a glorious day's work; in fact, so glorious that one wonders that men enough can be hired to pour off the molds as fast as made. These, as guaranteed by one maker, amount to three hundred 15 x 20-inch half molds per hour without the help of skilled labor. This means 150 complete molds per hour or 2½ complete molds made every minute by a crew of seven men. While the above figures are at first glance staggering, a little thought given to the matter makes one doubt the impressiveness of their performances when the pay of the seven laborers who operate this make of machine is augmented by the pay drawn by the pouring gang, sand cutters and riddlers, etc., who would number at least seven more. It is my honest belief that fourteen men operating ordinary hand worked squeezers, pouring off their own work and cutting their own sand, would in the long run put it all over these automatics in the production of **good** castings.

There is a point often lost sight of by those in command of foundries, and that is, that the race is not always won by the swift. It is all very well to make an immense number of molds on a molding machine, but it does not follow that good castings will result from each mold. In fact, I have lived long enough to see many a job taken from a machine and given to an experienced bench molder in order to get **any** production.

This may seem to be a wrong procedure to the uninitiated, but the most up-to-date foundrymen know it to be a frequent happening, and to try to explain why it is done would be too much of a job for one lifetime. The wisest men in the foundry game are not those who think they know what a molding machine will do; those who do know what a molding will **not** do usually win the cast iron shaving set.

Some there are who will tell you that a jar ram machine will overcome all molding troubles, and theoretically they are right, but experience teaches otherwise. On patterns with shelves and pockets of any considerable length and depth jar ramming does not fill the bill when not assisted by hand tucking. Also squeeze ramming more often fails when depended upon to produce a perfect mold unassisted by peen and butt ramming by hand. There are lots of machines that jar and squeeze ram the sand, and at least one make uses the three-fold jar, squeeze and vibrator method, to coerce the sand to lie properly



AMERICAN FOUNDRY EQUIPMENT MACHINE

against the pattern. On ordinary work, if intelligently handled, these will make good molds in jig time.

It is rather interesting to hark back to the old days when the Reynolds squeezer was about the only molding machine on the market. What a crude affair it was, literally thrown together, designed so that none but the very strong could operate it continuously for six or seven hours, and dodge a visit to the nearest hospital, as a result of the ground and lofty tumbling indulged in by the operator. It was some years after the advent of the Reynolds molding press before there were any improvements made in molding machines, but once properly started they came thick and fast; not always practical to be sure, but as part of the evolution that has resulted in giving us some splendid machines.

CONCLUSION

To sum it all up, then, the most essential features of molding machines suitable for brass foundry purposes can be stated as follows:

First.—The ordinary hand squeezer (with levers so arranged that compound leverage is a fact and not a delusion and a snare), with the back breaking strains eliminated.

Second.—The hand-operated squeeze and jar ram machine with cope lift and pattern drawing devices.

Third.—The rollover kind, sometimes equipped with the gravity drop for the pattern plate, with hand ramming on the side.

Fourth.—The jar ram, rollover, cope lifted, pattern drawing power machine.

Fifth.—The plain power jar ram with a table big enough to suit the work at hand, and cylinder area enough to lift the molds and allow them to drop on the anvil properly.

Sixth.—A shockless jarring outfit that will not cause ripples to form on the surface of a glass of water placed on its base; this machine is recommended in localities infested by nervous neighbors who sometimes complain when the ordinary jar rammer is in good health and stroking with a vim, and giving a real imitation of a trip hammer in action.

In the selection of any of these machines it is well to bear in mind the range of flask sizes each one will handle, without expecting any of them to include bench, side floor or center bay molds in its bag of tricks. One of the saddest sights I ever saw in a foundry was a big rockover drop machine being operated by two husky men with one 12x12x3-inch flask and pattern plate rig, which looked to me like a bedbug on the center of a soda cracker.

Again, I have witnessed flasks so big as to project over the ends of a jarring machine table a couple of feet or so. You can get away with this sort of thing at times, provided the pattern plate and flask are stiff enough and the lifting power of the machine is within its poundage, but it is not good practice.

There are other types of machines not included here, that I have had no experience with, such as the one suspended from a tramrail and moved along as the molds are made. Another is anchored to a post, thus leaving a space underneath for foot clearance and sand storage. Still another draws the pattern plate with a magnetic device, which means iron or steel contact pieces very firmly fastened to the plate if said plate is of aluminum or brass.

In closing, I will mention one more machine, just to show how far the machine idea was carried some sixteen years ago. I refer to the yielding platen type as used by the Atlas Engine Company* of Indianapolis, Ind. They molded a very wide variety of work on these machines from governor balls to engine beds of enormous length and tonnage. The patterns were rigged on stripping plates, the molds filled with sand by grab buckets, the platen swung over and hydraulic pressure brought to bear on the rubber sheet of its underside. It rammed the sand by conforming to the low and high spots of the pattern, again swung out of the way, top of the mold struck off, pattern stripped, mold lifted off, turned over ready to be blackwashed.

This bed machine was so big that it was built into a pit concrete lined, and its frame was built of fabricated steel columns and braces that gave one the impression that he was looking down into the subcellar of a skyscraper.

These machines were designed and built by this company, which had determined to conquer the molders' union forces in their efforts to restrict production, and a whole day spent at this foundry in 1904 convinced me that the Atlas Engine Company had won the battle hands down.

*A letter from the former manufacturers reads as follows:

"There would be no point in publishing any information regarding the molding machines made by the Atlas Engine Works, as the machine has not been manufactured by us for twenty years. So far as we know, there are none of them in use. We discontinued their use in this plant about two and one-half years ago, although they were used extensively on war work with very good results. We threw them out only because they were not fitted for our work. The patterns, drawings and equipment for manufacturing this machine have not been in existence for years."

Practical Foundry Mixtures

By F. W. LOLL

HIGH ZINC BRONZES

Hard Bronze

Copper	1 lb.
Zinc	1½ oz.
Tin	1 "
Lead	½ "

Bronze

Copper	1 lb.
Zinc	3½ oz.
Tin	½ "
Lead	½ "

Bronze

Copper	10 lbs.
Sheet Brass	3 "
Tin	5 oz.
Lead	4½ "

Bronze Metal

Copper	1 lb.
Zinc	1⅞ oz.
Tin	½ "
Lead	¾ "

R. & E. Bronze Mixture

Zinc	9 lbs.
Tin	5 "
Lead	5 "

Add 2 oz. to 1 lb. copper

Soft Bronze

Copper	1 lb.
Zinc	2 oz.
Tin	½ "
Lead	1 "

Statuary Bronze

Copper	5 lbs. 10 oz.
Zinc	5 "
Tin	2 "
Lead	2 "

Versailles Bronze

Copper	14½ oz.
Zinc	1 "
Tin	⅜ "
Lead	¼ "

TIN BRONZES

Bronze

Copper	1 lb.
Tin	1¼ oz.
Zinc	½ "
Lead	¼ "

Bronze

Copper	1 lb.
Tin	¾ oz.
Zinc	⅛ "
Lead	1/3 "

Bronze

Zinc	21 lbs.
Tin	4 "
Lead	9 "
Copper	3 oz. to 1 lb.

U. S. Bronze

Copper	90 lbs.
Tin	7 "
Zinc	3 "

Lock Bronze

Zinc	10 lbs.
Tin	6¼ "
Lead	2½ "
Copper	2 oz. to 1 lb.

Nickel Bronze

Copper	72 lbs.
Lead	22½ "
Tin	4½ "
Nickel	1 "

Ounce Bronze

Copper	16 lbs.
Tin	½ "
Zinc	¼ "
Lead	¼ "

Phosphor Bronze

Copper	21 lbs.
Tin	3½ "
Phosphorus	Trace

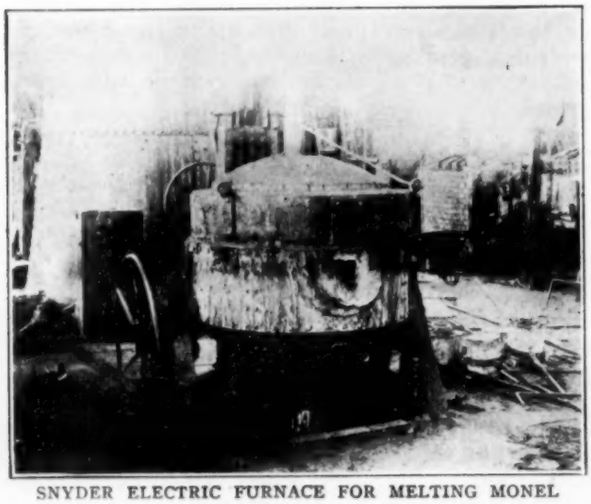
Monel Metal

A Summary of the Properties, Methods of Melting and Casting, Uses, Handling and Working in Up-to-Date Practice, of This Natural Nickel Alloy. Part 2*

Written for The Metal Industry by ADOLPH BREGMAN, Managing Editor

CASTING

It is of the utmost importance for the foundryman to realize that in casting Monel metal, he is handling something entirely different from any other material. In the first place a much larger percentage of metal goes into gates and risers than with most other alloys. No definite figure is possible, but it is sufficient to say that between 55 and 60 per cent is common. Monel metal has a very high shrinkage, and cools very quickly. The most important point to bear in mind is that the casting requires a large amount of surplus metal to take up the shrinkage, and that there must be sufficient pressure of liquid metal to allow for this. Gates and risers must be sufficiently large. Additional vents may also be inserted. Besides this it is often necessary to insert chills, wherever sections are especially large or thick. Before pouring, magnesium is added to the metal to deoxidize it, in proportions of about 1½ ounces to 100 pounds.



SNYDER ELECTRIC FURNACE FOR MELTING MONEL

The molding sand used must be coarse to allow the escape of the large volume of gases included in the metal. The molds are faced with a mixture of sand, 10 per cent sea coal and a little flour. Molasses water is used to bind the backing sand. The molds are not baked but merely skin-dried by means of a hand, oil-burning torch. Sharp sand is used for the cores with oil for a binder and silica wash over them.

Most of the molding is done directly on the floor but a few machines are in use. The metal is heated to 2,800° Fahr., and then poled with green wood to reduce or deoxidize the metal, this last operation usually taking only a few minutes. The metal is then tapped into bull ladles, magnesium added, the melt thoroughly stirred and poured into the molds.

USES

An alloy of this type has, of course, obviously, certain outstanding advantages. It is highly resistant to corrosion; it is tough and strong; it retains almost all its strength at high temperatures; it withstands the erosive action of steam; it can be cast, forged, rolled and fabricated into any desired form. Some of its uses are as follows:

Valve parts for superheated steam, high pressure steam and chemicals.

Turbine blading.

Marine condenser parts, such as tubes, etc.

Pump linings and rods for marine, mine and chemical uses.

Propellers, propeller shafts, marine fittings, such as deck fittings, stern bushings, rudders, stuffing boxes, shaft sleeves, etc.

Golf club heads.

Tie rods, nuts and washers on vats for tanners, platers and chemical works, pickling tanks for rolling mills, etc.

Dyeing and bleaching machinery—parts that come in contact with chemicals.

Laundry machine parts.

Dairy machinery—butter handling machines, milking machines, separators and pasteurizers, etc.

Pickling crates and frames for rolling mills.

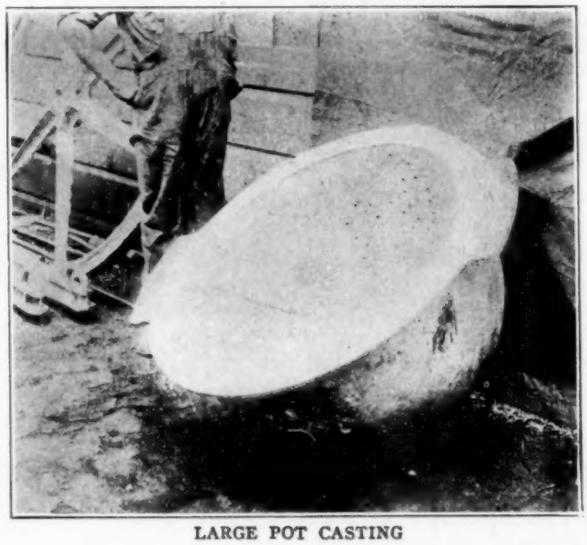
Pickling pins for rolling mills.

Valves for combustion engines (exhaust).

Ignition chambers for oil engines.

Mechanical conveyors and containers in furnaces for tempering and forging.

Incinerator and sewage handling machinery.



LARGE POT CASTING

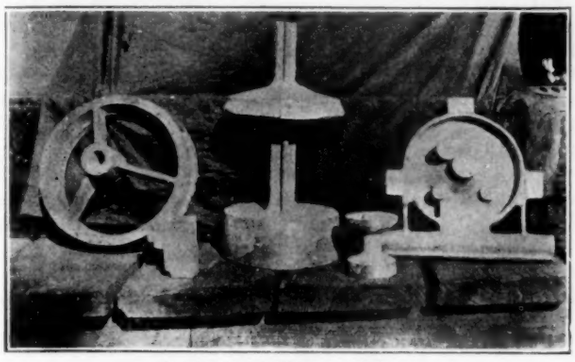
HANDLING AND WORKING

Monel metal is turned out in standard commercial forms, among which are hot rolled and cold drawn rods, wire, annealed and hard, and sheets. It machines with a very long tough chip, which resembles copper, but is much tougher and requires more power to cut. Rolled or drawn Monel metal calls for about the same power to machine as mild steel, but cast Monel metal needs a little more. The best grade of tools is necessary, such as high speed steels. Under ordinary circumstances it can be cut dry, but when lubricants are required the following can be used:

*For Part 1, see THE METAL INDUSTRY, January, 1921.

1. Lard oil and 10 per cent turpentine for fine boring.
2. Machine oil and Exanol for general work.
3. Mineral Lard Oil, of plus 300 test burning oil, for threading.
4. Lard Oil—Borax and Aquadag for cutting off.
5. Oakite for milling.

Cutting speeds can be varied from 8 feet per minute for heavy work to 250 for light, average 50 to 60 feet per minute, with ⅛ inch cut, and 1/32 feed. It is important that the tool be kept sharp.



VARIOUS MONEL CASTINGS

ANNEALING

The best annealing temperature is between 800 and 1,000 degrees centigrade (1,475 and 1,850 Fahr.) for rods. Sheets should be heated above 875 centigrade, 1,600 Fahr. Castings need not be annealed. It is important that the metal be thoroughly and evenly heated. As the conductivity is low this will take much longer than with other metals. The manufacturers recommend that Monel metal be annealed, whenever possible, completely enclosed in charcoal in tight boxes, so as to prevent and eliminate oxidation.

PICKLING

Pickling is very difficult and should be avoided wherever possible by preventing oxidation, but if necessary the manufacturers recommend the following procedure:

"Make a 12-degree Beaumé solution of ferric sulphate in water. A large excess of ferric sulphate does little harm to the metal and greatly decreases the time of pickling, but tends to increase pickle consumption. Sufficient ferric sulphate should be kept in the solution at all times to prevent any deposit of copper. This solution works best 100 to 140 degrees F.

"If the oxide is not too heavy, pickling can also be done with a hydrochloric acid solution of 1.1 specific gravity at boiling temperature.

"In pickling Monel metal, it should be kept strongly in mind that the scale is a mixed oxide of copper and nickel so that its solution puts copper in the bath, and also that Monel metal has the property of cementing copper just as iron does. This cementation or 'coppering' is prevented by the method described, but care should be taken to keep all iron pins and bars from any continued contact with the Monel metal, and no iron bands, wires or fasteners should be used.

"During pickling, part of the scale is dissolved and the rest remains adhering to the metal so that the progress of the pickling should be observed by removing a piece of metal from the bath and washing with a jet of water or rubbing with a piece of waste. When the scale becomes loose so that it may be easily rubber off, remove the metal and wash it with a jet of water or scrub with a brush to remove all adhering scale."

POLISHING AND FINISHING

The metal takes a high polish, and when buffed is hard to distinguish from pure nickel. The manufacturers have issued the following instructions for polishing and finishing, which are of considerable value to the metal worker:

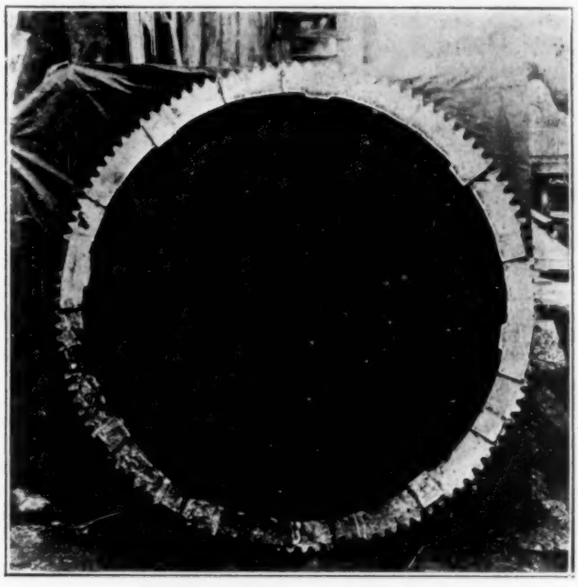
Castings. In polishing castings it is necessary to use:

1. A solid stone, of which there are several grades and makes. Norton Company's Grade "Q" Grain No. 20; also Carborundum Company's Grade "G" Grain No. 16 has been found very satisfactory.
2. A rag, wood or canvas wheel coated with No. 40 emery.
3. A rag, wood or canvas wheel coated with No. 120 emery.
4. A rag, wood or canvas wheel coated with No. 120 emery and finished with an ordinary buff, using buffing compound.

Hot Rolled Rods. In polishing rods it is necessary to use:

1. A rag, wood or canvas wheel coated with No. 90 emery.
2. A rag, wood or canvas wheel coated with No. 120 emery.
3. A rag, wood or canvas wheel coated with No. 120 emery and finished with an ordinary buff, using buffing compound.

Sheets. In polishing sheets it is necessary to use:



UNUSUAL MONEL CASTING

1. A rag, wood or canvas wheel coated with No. 90 emery.
2. A rag, wood or canvas wheel coated with No. 150 emery.
3. A rag, wood or canvas wheel coated with No. 150 emery and finished with an ordinary buff, using buffing compound.

Anti-Friction Bearing Metals

Chemical, Physical, and Thermal Review

By P. W. PRIESTLEY

In view of the large quantities of anti-friction bearing metals employed in industry it is surprising to find that very little information is available which is of direct value to the engineer in the selection of white metal bearing alloys most suited to the wide range of machinery into which this class of material is introduced. On this account it is thought that a review of the data already published, coupled with experience gained in connection with aircraft and automobile construction, would prove of interest to users of anti-friction alloys and possibly enable the metallurgist and bearing metal manufacturer to more clearly understand the essential points of interest to the engineer. It will be noted that the following remarks apply mainly to the tin-rich mixtures which have been so successfully applied in high speed internal combustion engine construction, although it is expected that serviceable information will be found by those engaged in a wider field of bearing practice.

Essential Characteristics.—The most desirable alloy is one having hard grains embedded in a relatively soft material. The function of the hard constituent is resistance to wear and to provide a surface having a low coefficient of friction, whilst the softer constituent permits a uniform distribution of load, which prevents local heating and seizure, due to the possibility of adjustment, partly by distortion and partly by rapid wear, leaving the particles of the hard constituent in slight relief, which forms a suitable surface for directly sustaining the load. It is further claimed that the hollowness of softer areas assists in promotion of efficient lubrication. It is, therefore, necessary to secure an alloy in which the mixture does not permit lateral flow and yet in which there is no excess of hard constituent creating a tendency to prevent adjustment with consequent liability to heating.

Composition.—Satisfactory results are obtained with the binary alloys of copper-tin, tin-antimony, and lead-antimony, but more satisfactory results are obtainable from the ternary alloys tin-antimony-copper, tin-lead-copper, and tin-antimony-lead. Unfortunately the ternary alloys named have not been thoroughly investigated, but it is considered that the tin-antimony-copper mixtures are at the present stage most successful under actual working conditions.

The following tabulation records typical compositions of anti-friction metals employed in the construction of aircraft and automobile engines:

Alloy No.	Application	Analysis Sn.	Sb.	Cu.	Pb.	Misc.
1	Aircraft, American.....	91.00	4.00	3.50	1.00	0.50
2	" British	90.72	5.33	3.80	—	0.15
3	" French	90.15	3.90	4.80	0.27	0.88
4	" German	80.71	10.05	6.95	2.26	0.03
5	Automobile, American.....	84.00	9.00	7.00	—	—
6	" British	86.00	10.50	3.25	—	0.25

INFLUENCE OF CONSTITUENTS

Antimony.—Increases hardness, wearing qualities and brittleness. Ultimate antimony content is reduced when a high casting temperature is employed, hence an alloy having a high antimony content is not exposed to the danger of such severe losses in the final metal as in the case of mixtures produced with low antimony content.

Bismuth.—Trace may be introduced in the capacity of a flux.

Copper.—Prevents segregation and increases hardness qualities, but when present in quantities exceeding approximately 5 per cent promotes brittleness and tendency to crack when used in high speed engines.

Casting temperature is increased with consequent coarsening of structure.

In alloys containing this element, rapid cooling considerably increases the hardness as compared with slowly cooled alloys.

Iron.—Increases hardness and brittleness, and is considered an undesirable impurity.

Lead.—Small proportions are permissible since its presence increases fluidity during casting and in the ultimate metal promotes ductility and resistance to rapid changes in loading. American practice permits quantities up to 3 per cent, and is present in solid solution in the ground mass of the alloy, having little effect on melting point. English practice generally excludes this element in quantities exceeding 1 per cent. Large quantities produce a soft alloy and cheaper product, and it is thought that lubricants containing an excess of alkali will pit lead rich mixtures.

Nickel.—In quantities not exceeding 0.50 per cent nickel increases ducility and removes liability to crack without affecting hard wearing qualities.

Tin.—In large percentages tin promotes rigidity and increases wearing qualities. Cost of a bearing metal is controlled by tin content, since this element is by far the most expensive ingredient contained in any form of anti-friction alloy. The ternary alloys have not been completely investigated, but it is found at the present stage that the tin-rich alloys are most successful under severe working conditions.

Zinc.—Creates a tendency to sieze and increases hardness and brittleness. It is thought that a detrimental action may take place in the presence of salt water or benzol when zinc is present and this element is considered an undesirable impurity.

Hardness.—It is thought by some authorities that the Scleroscope hardness test excels the Brinell method on account of greater differences revealed following treatment, although it is evident in the absence of any definite relationship between hardness and wearing properties that any form of hardness test applied to the class of material under review has little merit.

There is, however, a relationship between Brinell hardness and compressive strength in tin-rich alloys, and it may be noted here that a mixture having a Brinell hardness 34 has an approximate compressive strength of 24,000 pounds per square inch, and that with a decrease of hardness value there is proportionate increase of strength under compression load within a range terminated by an alloy having a Brinell hardness 20 accompanied by a compressive strength of some 42,000 pounds per square inch. The compression figures indicate the load which the metal will withstand without cracking, and the limits of the range quoted represent the extreme conditions observed by the author. Chemical analysis and rate of cooling considerably affect the hardness values and, therefore, the ability of the alloy to withstand compression stresses.

Brittleness.—The general rule that the brittleness of an alloy increases rapidly with hardness does not obtain in tin-rich alloys, which, even with relatively high hardness values, show no signs of brittleness under impact stresses. The presence of a trace of nickel, say, 0.50 per

cent, considerably increases the ductility of tin-antimony-copper bearing metals.

Mechanical Tests.—At the present stage there does not appear to be any direct relationship between the co-efficient of friction, hardness or compressive strength and the durability factor of any alloy or series of alloys. It is concluded, therefore, that the mechanical tests applied to constructional materials are of little benefit in the selection of a bearing metal, and until a formula or some tangible data is available showing relative merits and values between physical tests and service attainments, commercial mechanical tests apparently serve no useful purpose.

Casting.—When a warm sand mould is employed slight differences of temperature do not materially affect the structure of the tin-antimony-copper mixtures except that the arrangement of copper-tin needles is more regular than obtains when a cold sand mould is employed.

Cold metal moulds or moulds warmed to temperatures up to 100c produce a material with chilled borders, and a rise in pouring temperature from 300c to 400c increases the depth of the chill. When temperature of mould is raised to 200c and casting temperature of 350c is employed the structure is uniform and fine grained throughout, becoming somewhat finer at the extreme edges. Brinell impressions indicate that chill cast specimens are generally harder than sand cast examples.

In sand castings there is a marked diminution in the number of relatively large crystals at the bottom of the casting of ingot and a corresponding increase at the top, showing that the crystals have a lower specific gravity than the liquid tin-rich matrix in which they are found, and a tendency to rise to the top is noted when slow solidification is permitted.

Casting Temperature.—The structure of these alloys should not be excessively fine or coarse, and best results are obtained when poured at a temperature slightly over the freezing point.

A casting or pouring temperature of 300c is not likely to produce a uniform structure, since this temperature is just below the liquidus of the alloy and the liquid already contains large crystals of one of the constituents.

A casting temperature of 600c produces a coarse crystalline structure with large antimony-tin cuboids reaching 0.09 mm. A casting temperature of 400c produces cuboids approximating 0.07 mm., but the copper-tin constituent does not form the copper-tin network characteristic of slow cooling when warm sand moulds are employed.

In chill castings there is considerably less difference between castings poured at 300c and 400c respectively than in sand castings. A fine granular structure is seen in both cases, but is more uniform when poured at the higher temperature.

The antimony-tin cuboid crystals in chill cast alloys are uniformly distributed throughout the entire section, whereas a concentration of these crystals is found at the top of sand castings.

A dangerous crystalline structure is exhibited when a high pouring temperature is employed.

RATE OF COOLING

During solidification there is a tendency with certain mixtures for the antimony-tin cuboids to rise to the top of the metal, and the only method of prevention lies in chilling the molten metal to bring about rapid solidification.

A distinct softening is noticeable at a temperature of 100c, and it is thought that the hardening effect of rapid cooling revealed under test and the distinct softening when cooled slowly indicates that the rate of cooling rather than the casting temperature controls the ultimate hardness.

The following tabulation records representative figures showing hardness properties after slow and rapid cooling:

Nature of Test.	Rate of Cooling Slow	Rapid
Scleroscope	6 to 7	12 to 13
Brinell 500 kg.	4.9	4.7

Under Scleroscope test the chilled alloy has a hardness unit practically double that of the slowly cooled metal, whilst the Brinell impressions are almost identical, from which it appears that the hardness produced by rapid cooling is distinct under comparatively light loads to that which obtains under a heavy load, so that it becomes necessary to review carefully the duty which a bearing metal has to perform in considering the desirability of heat treatment.

Extremely slow cooling of molten metal produces a dangerous crystalline structure.

Pouring.—Service results depend very largely upon careful and skilled manipulation during pouring operations, and the following procedure describes a very successful method of lining bronze bearing shell similar to those employed in automotive construction.

PREPARATION OF SHELLS

1. Heat in bunsen flame to dull red.
2. Immerse in strong boiling solution of caustic soda for one minute.
3. Tin carefully and completely over bunsen flame with solder comprising two parts lead, five parts tin, and employ the following flux: Anhydrous zinc chloride, 50; Amin chloride, 49; Sodium fluoride, 1.
4. Wash in clean boiling water to remove flux.
5. Mount in fixture which should set the horns of bearing in the highest position and provide suitable header.

PREPARATION OF METAL

1. Employ small melting pots conveniently arranged with spouts and handles. Carefully clean and coat pots with blacklead prior to each pour. Do not melt more than one to one and one-half pounds of metal in each pot.
2. To melt metal immerse pots in bath of old molten metal provided with suitable burners to maintain at H—350c, L—325c, and stir well and frequently. Graphite may be used as a flux to prevent oxidation.

POURING

1. Pre-heat fixture and shell by immersion in bath of molten metal at H—350c, L—325c.
2. Pour metal immediately at H—350c, L—325c, and puddle with clean wire to ensure that air or gas bubbles rise to header.
3. Quench in water when metal solidifies.

Heat Treatment.—Heat treatment is unnecessary in small bearing shell, since no difficulty is experienced in cooling rapidly, and, therefore, in securing the desired structure. Where large bearings are concerned it is advisable to heat to a temperature of approximately 150c and quench in water with the object of eliminating the segregation of antimony-rich cuboids.

Lubrication.—The successful application of any bearing alloy depends very much upon the attainment of lubricating conditions that will ensure the continuous existence of an oil film between the bearing surface and the bearing journal.

Some Properties of White Metal Bearing Alloys at Elevated Temperatures

Abstract of a Paper by JOHN R. FREEMAN, Jr., Assistant Physicist, and R. W. WOODWARD, Associate Physicist, Bureau of Standards, Washington

There is described in this paper an apparatus for determining the yield point and ultimate strength of white metal bearing alloys at temperatures up to 100° C. A new design of heating apparatus is also described for determining the Brinell hardness of metals at temperatures up to 100° C.

Tests were made of the following series of bearing metals:

ALLOY NO.	1	2	3	4	5
Copper—Per cent	4.56	3.51	5.65	2.90	None
Antimony—Per cent	4.53	7.57	6.90	10.50	10.03
Tin—Per cent	Remainder	Remainder	Remainder	Remainder	Remainder
Lead—Per cent	None	None	0.09	25.05	84.95
Iron—Per cent	Less than 0.05	Less than 0.05	Less than 0.05	Less than 0.05	Less than 0.05

The results of the determinations of Brinell hardness at elevated temperatures is shown below:

Brinell Hardness

ALLOY NO.	TEMPERATURE 25° C.	50° C.	75° C.	100° C.
1	17.2	13.8	11.1	8.2
2	22.3	.....	....	....
3	22.3	18.2	14.8	11.3
4	22.4	15.8	11.3	7.5
5	19.7	16.8	11.4	8.2

The compression tests were made on cylinders 1½ inches long by about ½ inch diameter, machined from chill cast cylinder 2 inches long and ¾ inch diameter. The samples for Brinell testing were cast in an open steel mold 2 inches in diameter and ⅝ inch deep. Impressions were made on the bottom face after machining off the surface, a load of 500 Kg. was used, applied for 30 seconds with a 10 mm. ball.

The following table gives the results of the compression tests of the five alloys at the various temperatures:

These results indicate that the tin base alloys maintain their properties better at elevated temperatures than the lead containing alloys.

Other tests show that the yield point of tin base alloys is not affected by heating for six weeks at about 160° C., but the yield point is lowered in the lead base alloy by heating for two weeks at the same temperature.

Experiments were also made which indicate that up to 5 per cent of lead in a high tin babbitt does not affect the yield point or ultimate strength at 25° C. or 75° C.

Compression Tests

TEMPERATURE / ALLOY NO.	25° C. YIELD PT., LBS. SQ. IN.	25° C. ULTIMATE STRENGTH, LBS. SQ. IN.	50° C. YIELD PT., LBS. SQ. IN.	50° C. ULTIMATE STRENGTH, LBS. SQ. IN.	75° C. YIELD PT., LBS. SQ. IN.	75° C. ULTIMATE STRENGTH, LBS. SQ. IN.	100° C. YIELD PT., LBS. SQ. IN.	100° C. ULTIMATE STRENGTH, LBS. SQ. IN.
1	4,400	12,850	3,800	10,400	3,150	8,450	2,650	6,950
2	6,250	15,175	4,850	11,850	4,000	9,400	2,850	6,825
3	5,750	16,425	5,000	12,175	4,250	10,100	3,350	7,725
4	4,700	13,685	3,650	10,035	2,900	7,845	2,150	6,045
5	3,750	15,020	2,650	11,275	2,250	7,920	1,550	4,771

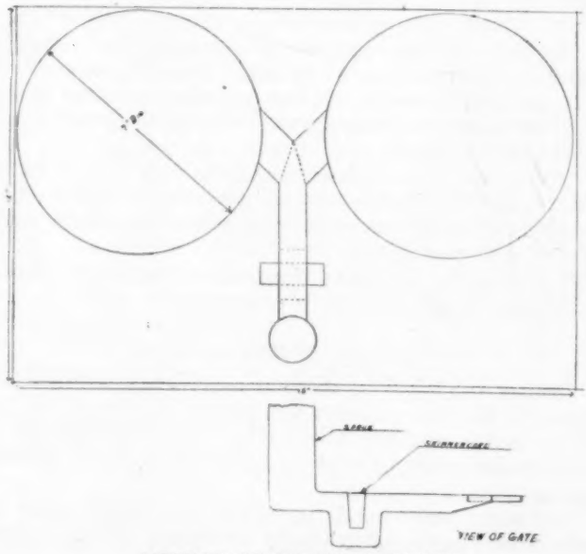
MOLDING FOR YELLOW BRASS

Q.—Please advise us as to the grade of sand that would be best to use in molding yellow brass ferrules about 4 in. by 5 in. in size. We are having trouble to keep gas out of the castings.

Please advise us the best method to use in making brass closet floor flanges such as plumbers use when setting a toilet bowl. It is a ring shaped article about 7 inches in diameter, weighing 8 ounces each.

A.—First. No. 2 Albany sand will prove satisfactory for this work. However, I do not think the trouble is in the sand, and would suggest that you try a small amount of aluminum not over 0.5 per cent. This will quiet the metal and it will not smoke when poured since it is fluid and will run the ferrules satisfactorily, whether made from scrap yellow brass or new metal, I would suggest that you get as near a mixture of 56.50 copper, 40 zinc, 3 lead and 0.5 aluminum as possible.

Second. I would suggest casting two castings in a mold like sketch, and pour with same material. 12 x 18 flask.—W. J. Reardon.



METHOD OF GATING FERRULES

Ferric Sulphate as a New Etching Reagent in the Metallography of Aluminum*

A Description of the Use of Aqueous Solutions of Ferric Sulphate for Distinguishing $CuAl_2$ and $FeAl_3$

By ROBERT J. ANDERSON†

INTRODUCTION

The difficulty of preparing suitable microsections and the scarcity of appropriate etching reagents for distinguishing metallographic constituents have been deterrents to the microscopic study of aluminum and its light alloys. Numerous chemical etching reagents have been either tried or suggested, but the ones most commonly used for both substantially pure aluminum and its light alloys are aqueous solutions of sodium hydroxide and hydrofluoric acid.[1] Both of these reagents, in various concentrations, are fairly satisfactory for general use in differentiating constituents or developing microstructure in both substantially pure aluminum and in certain of its light alloys, but the need has constantly been felt for better reagents.

In the metallography of the light aluminum-copper alloys, need has been felt for a chemical etching reagent that would develop microstructure and sharply differentiate constituents at the same time. In the microscopy of light aluminum-copper casting alloys, for example, ordinary No. 12 alloy containing up to 2.0 per cent iron, the sharp differentiation between $CuAl_2$ and $FeAl_3$ is essential. Sodium hydroxide, whether in very dilute (say 0.10 per cent), or in concentrated, solution has never been found satisfactory for this purpose. Hanson and Archbutt[2] have recommended the use of 20.0 per cent aqueous solution of nitric acid for coloring the $CuAl_2$ when in the presence of $FeAl_3$ and most other constituents. This reagent yields excellent results when the manipulation is carefully carried out, but the etching must be done at 70° C., and other exact precautions must be observed. If the etching is not performed in accordance with the directions, very variable results are likely to be obtained. Ordinarily, $CuAl_2$ is visible as a bright, white constituent in the unetched microsection, and when etched with sodium hydroxide it can be distinguished from $FeAl_3$, only with much difficulty. In order to distinguish these two constituents when present together in disproportionate percentages, considerable experience must have been had with the microscopy of iron-bearing aluminum-copper alloys, if either sodium hydroxide or hydrofluoric acid are used for etching.

The present paper describes the use of aqueous solutions of ferric sulphate for distinguishing $CuAl_2$ and $FeAl_3$ in the metallography of aluminum.

USE OF FERRIC SULPHATE

The remarkable etching effects of ferric sulphate on aluminum were first observed by J. H. Capps and the present writer, so far as is known, in connection with analytical experiments carried out for the direct determination of metallic aluminum. The results of numerous etching experiments have shown that ferric sulphate, $Fe_2(SO_4)_3$, when used in aqueous solutions of various concentrations is an eminently satisfactory etching reagent for distinguishing $CuAl_2$ from $FeAl_3$, particularly in iron-bearing light aluminum-copper alloys. Since the greatest part of the light aluminum-alloy manufactures produced at the present time are in No. 12 and related alloys, this reagent may find considerable application. The concentration of the solution may vary over a fairly wide range, but a 10.0 per cent solution is suitable for general use. With a 10.0 per cent solution, an immersion period of about 45 seconds yields good results, and with a 5.0 per cent solution, an immersion period of about 2.0 to 5.0 minutes may be employed—3.0 minutes yielding good effects. Prior to etching with ferric sulphate, the microsections are prepared according to the usual recommended procedure. The solution is made up by simply dissolving the solid salt in water in the desired proportion.

Etching in ferric sulphate is done by simple immersion of the microsection, and no rubbing of the surface with the reagent is required. The precaution must be observed, however, of having the microsection free from any oil or grease, and the prior polishing must have been done very carefully.

ETCHING EFFECTS OF FERRIC SULPHATE

Upon immersing a microsection in a solution of ferric sulphate, there is no noticeable evolution of hydrogen as in the case when sodium hydroxide or hydrofluoric acid are employed. The violent evolution of hydrogen, which accompanies the use of either of these reagents, is one of the chief objections to their employment. Both sodium hydroxide and hydrofluoric acid attack not only the constituents to be differentiated, but the aluminum-alloy matrix as well. The result is that the surface of the microsection becomes roughened and pitted even with dilute solutions and short immersion periods, and it is normally necessary to attempt to brighten the surface with chromic acid or nitric acid.

The behavior of ferric sulphate when used for etching light aluminum-copper alloys is similar to the behavior of ammonia persulphate for copper-rich alloys (bronzes). The reagent seems to have one defect; viz., it has the power of revealing "latent scratches," much as has acidic ferric chloride in the metallography of brass and bronze. By employing exceptional care in the polishing process, prior to etching with ferric sulphate, this defect can be overcome. As already stated, the etching action of both sodium hydroxide and hydrofluoric acid takes place with the evolution of gas bubbles which are likely to adhere to the polished surface and cause uneven effects.

When a polished microsection of a light aluminum-copper alloy (say an alloy containing about 91.0 per cent aluminum, 8.0 per cent copper, and 1.0 per cent iron) is immersed in a dilute aqueous solution of ferric sulphate, the iron-aluminum compound, $FeAl_3$, is practically unaffected, but the $CuAl_2$ is colored brown to black, depending upon the period of immersion. This effect serves to sharply differentiate these two constituents, but the reagent is useful for coloring $CuAl_2$ in most light aluminum alloys containing copper in sufficient amount to form this intermetallic compound. The photomicrographs in Figs.

* Published by permission of the Director, U. S. Bureau of Mines.

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[1] Anderson, R. J., Metallography of Aluminum; preparation and etching of microsections, Met. and Chem. Eng., Vol. 18, 1918, pp. 172-178; The Metallography of Aluminum, Jour. Franklin Inst., vol. 187, 1919, pp. 1-47; and Metallography of Aluminum Ingot, Chem. and Met. Eng., vol. 21, 1919, pp. 229-234.

[2] Hanson, D., and Archbutt, S. L., The Micrography of Aluminum and Its Alloys, Jour. Inst. of Metals, vol. 21, 1919, pp. 291-304.

1 to 10 inclusive show a number of structures developed by the use of this reagent for different commercial aluminum-copper alloys. In all cases, the 5.0 per cent aqueous solution was used, and the immersion period was 5.0 minutes.

Figs. 1 and 2 show the microstructure of a section

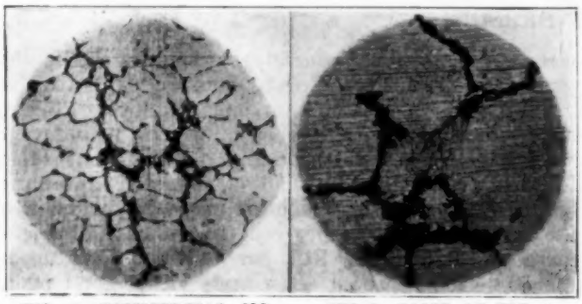

FIG. 1—COMMERCIAL NO. 12 ALLOY; X 130

FIG 2—SAME AS FIG. 1, BUT X 500

cut from a sand casting in an alloy containing about 91.5 per cent aluminum, 8.0 per cent copper, and 0.50 per cent iron. The contrast between the unattacked $FeAl_3$ (white) and the $CuAl_2$ (black) in Fig. 2 is marked. Fig. 3 shows the microstructure of a similar section; the

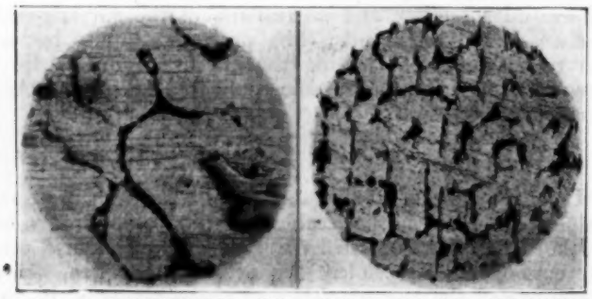

FIG. 3—COMMERCIAL NO. 12 ALLOY, HIGH IN IRON; X 500

FIG. 4—ALLOY CONTAINING ABOUT 12.0 PER CENT Cu, 1.0 PER CENT Fe, AND REMAINDER Al; X 200

alloy contained about 89.0 per cent aluminum, 8.0 per cent copper and 3.0 per cent iron. The hard white $FeAl_3$ masses are seen standing in relief. Figs. 4, 5 and 6 are photomicrographs of a chill-cast light aluminum alloy containing about 87.0 per cent aluminum, 12.0 per

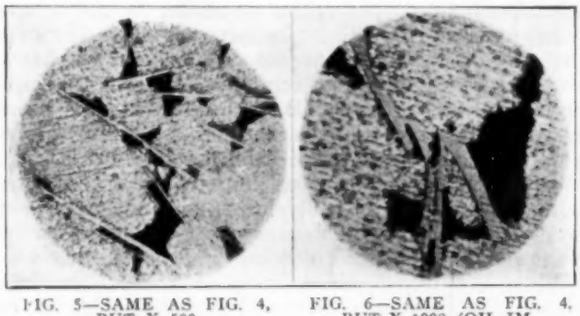

FIG. 5—SAME AS FIG. 4, BUT X 500

FIG. 6—SAME AS FIG. 4, BUT X 1000 (OIL IMMERSION)

cent copper, and 1.0 per cent iron, while Figs. 7 and 8 are photomicrographs of a similar alloy containing about 86.0 per cent aluminum, 13.0 per cent copper, and 1.0 per cent iron. The black constituent in these figures is the $CuAl_2$ and the white needles are the $FeAl_3$. Figs. 9 and 10 are photomicrographs of a chill-cast rich alloy containing about 34.0 per cent copper, 0.50 per cent iron, and remainder aluminum. This is the eutectic alloy of the aluminum-copper system. The microstructures are those of typical eutectics. Delta, the intermetallic compound $CuAl_2$, appears light, being electronegative to the eutectic.

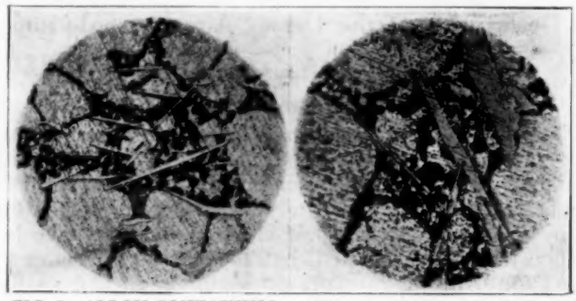

FIG. 7—ALLOY CONTAINING ABOUT 13.0 PER CENT Cu, 1.0 PER CENT Fe, AND REMAINDER Al; X 275

FIG. 8—SAME AS FIG. 7, BUT X 600 (OIL IMMERSION)

It is hoped that this description of the effects of ferric sulphate in the metallography of aluminum will be found of interest to metallographers in general and that the

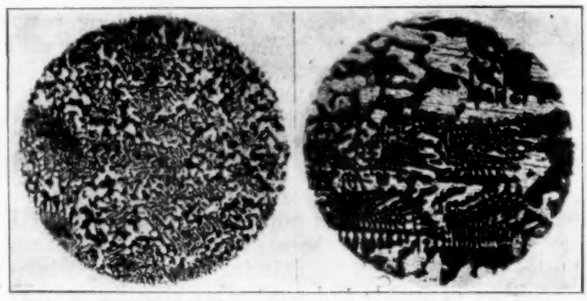

FIG 9—COMMERCIAL 33:67 COPPER-ALUMINUM ALLOY; X 130

FIG 10—SAME AS FIG. 9, BUT X 350

new reagent may be of use to those working on the microscopy of light aluminum alloys.

Tinning Copper

1. Is the coating pure tin or can some lead be used?
2. Is method as described in METAL INDUSTRY March, 1913, the method in common use?
3. Are sheets always rolled after tinning, and if so, is metal given a light draft at this time or is it only a straightening and smoothing out operation?

1. While a coat of pure tin is supposed to be and is claimed to be used by some mills on sheet copper, it is a fact that some lead is generally used, for the reason that a small per cent of lead enables the tin to flow more freely and eliminates lumps. For utensils that are lined with tinned copper for culinary purposes the percentage of lead should be very small, and it would be much better if no lead were used at all.

2. The method mentioned is still in common use, but electrolytic methods for tin coating are being developed, and in one or two instances are already in use. A number of mechanical devices for automatic tinning of copper sheets on one or both sides have been brought out. One of these in particular was mentioned in the METAL INDUSTRY in September, 1913, and since that time several other machines of varying merit have come to light.

3. You are correct in your assumption that the copper sheets after being tinned are given a pass or two through the rolls, this is only to be sure of a flat level surface, and also to give the tin coat a bright or semi-polished finish.—L. J. Krom.

Deposition of Metals on Wax

A Compilation of Some of the Methods and Processes Used

Written for The Metal Industry by SAMUEL WEIN

There are four applications to which the deposition of metal on wax lends itself, photo-engraving, phonographic record masters, plastic and other ornamental pieces, and as a mold or pattern for the manufacture of metallic articles of various shapes. The first two applications are quite important and are practiced on a large scale over the civilized world, whereas the other two processes receive little attention. This is due to the fact that other methods are used with better results and more economically.

In these processes there are three separate and distinct methods of procedure, this depending on the application for which it is intended. For instance, phonographic records and photo-engraving are similar, the first step being to make the wax impression conducting, and then to deposit the metal (usually copper); after a certain thickness has been obtained the metal "shell" is pried off in any convenient manner. This is then "backed up" to the height convenient for handling it when it is ready for use.

In the case of making plastic or ornamental pieces the work is the same as above excepting the removal of the metal. This process is used but little, as plaster of Paris is used extensively and is, in fact, better to handle.

The fourth application, that of making metallic articles by depositing the wax surface and afterwards running out the wax by melting it, is also used but little, as the metal has a tendency to change the shape of the wax core while the metal is deposited, due to the pressure. Fusible cores are used instead and with better results.

Whatever the application is, the first thing to bear in mind is that wax is a non-conductor of electricity, so it is impossible to deposit metals directly on it. For this purpose various means have been devised in making the wax surface take a deposit.

The phonographic and photo-engravers take ordinary graphite and brush it over the surface, but this is a tedious operation, and it takes considerable time to cover the entire surface properly. Mechanical means have been devised to accomplish this end. In one case a series of brushes are brought on the surface and the graphite mixed with water is rubbed over the wax surface; another process is to take the water and graphite and to spray it on the wax surface. The phonographic record manufacturers use only dry graphite.

The next step is to place the wax in an acid copper sulphate solution and deposit the metal thereon. Some electrotypers make it a practise to place the wax tablet in a shallow basin in which a copper sulphate solution is poured. The solution must cover the surface of the wax. Iron filings are sprinkled over the surface and a copper "flash" deposits. The object of this is to facilitate the deposition, as graphite, even at best, is a poor conductor of electricity, especially in such a fine state of division.

Mr. Schor of New York has devised quite an interesting method of improving the conductivity of the graphite, by adding metallic salts to it, as in the following case:

Silver nitrate	10 parts
Graphite	100 parts
Water	200 parts

The mass is stirred well, placed in a porcelain dish and allowed to dry. With the aid of a water bath the moisture can be evaporated a little faster than by drying in the air. After this is dry the mass is calcined at a red heat in a covered crucible. After cooling the product is broken up, crushed to an impalpable powder and sifted.

The results obtained by the use of this material are excellent; in fact, a metallic flash will take on the wax surface much more readily than by the use of plain graphite.

A somewhat simplified formula consists of:

Silver nitrate	10 grams
Graphite	100 grams
Water	10 ounces

Dry and expose to a red heat. The crucible must be well protected from the action of the air. The silver nitrate is first absorbed by the graphite, and by fusing is converted into metallic silver, so that the graphite becomes intimately incorporated with the best conducting material known, and in the finest state of division.

Graphite can be similarly gilded with the following mixture:

Graphite	100 grains
Gold chloride	2 dwts.
Ether	10 ounces

The product is exposed to the light and is followed by gentle heating in an oven; it is afterwards treated as in the case of silvered graphite.

A modified formula consists of:

Graphite	1 gram
Gold chloride	2 dwts.
Potassium cyanide	10 grams

The potassium cyanide is dissolved in sufficient water, the gold chloride is added and then the graphite. The mass is stirred, placed in an oven and heated to about 600 deg. C. The product, after cooling, is treated as in the case of silvered graphite.

Many years ago some electrotypers made use of a phosphorus solution which was made up of:

Phosphorus	1 part
Carbon bisulphide	2 parts

The wax is either dipped or painted with this compound and placed away to dry, preferably in the light. It is then dipped in:

Silver nitrate	½ ounce
Water (distilled)	1 quart

The wax is then rinsed slightly and placed in the plating solution.

McElhone found that by the addition of a reducing compound to the graphite its conductivity is greatly increased. The compound he advocates consists of:

Graphite	2 pounds
Pyrogallic acid	200 grains
Water	1 gallon

The mixture is applied to the surface either by a brush or spraying it on. The writer has had the occasion to try this recipe and although it did work, it was found to work only when it was used fresh. Pyrogallol has a tendency to oxidize in solution and deteriorates rapidly. Other reducing agents may be used and in all probabilities with better results. Such reducing agents as are used for photographic developers can be used and that can be bought at a comparatively low price.

There are other methods of depositing wax. The mixtures given below are used when the deposited metals are not to be removed from the wax surface.

Prepare a celluloid lacquer consisting of:

Lacquer	½ pint
Amyl acetate	½ pint
Bronze powder	3 ounces

This is applied preferably by means of an air brush.

Some electrotypers make use of a shellac lacquer dissolved in alcohol and the bronze powder or graphite added to the consistency of a thin paint. This is applied to the wax surface. The objection to this method is that the alcohol dissolves some of the waxes in common use by the electrotypers, thus ruining the fine detail.

The following formula is used by a Japanese worker and is giving good results:

Graphite	10 parts
Mercury chloride	6 parts
Silver nitrate	12 parts
Bronze powder	10 parts

Add the above to a 10 per cent solution of casein to the consistency of a thin paint. The mass must be thoroughly mixed and it is applied to the surface. This is then steamed in formalin vapor. The casein is coagulated and the silver nitrate and the mercury chloride are reduced to metallic silver and mercury. On this the metal deposits readily.

Casting Shop and Melting Room Equipment

By EQUIPMENT ENGINEER

The selection of a process for the casting and melting of non-ferrous metals, particularly brass and copper alloys, necessitates careful consideration of some obscure but very important factors. It is not uncommon to find that prejudice in favor of a certain method or of equipment is allowed to govern the selection with the result that the operations, expansion and development of the business as a whole are hampered. This is true not only of melting and casting but of many other operations. For example, a furnace may be selected because it saves labor or uses cheaper fuel, or is more "efficient," without consideration being given to the question of whether the best possible quality of product can be obtained, whether expansion of the business will be limited and if developments in the way of new products will be hindered.

The outstanding difference between English and American practice is that American mills are well equipped to turn out large production at low cost. English mills are operated at slower speeds, smaller units are employed, and there is specialization of equipment rather than standardization. The result is that while English costs are relatively higher and production less they can give more attention to detail, produce greater variety of products and can handle small orders much more economically than can most American mills. This flexibility or elasticity (i. e. the number of different products that can be produced by the same equipment) is a most valuable feature of the business and is to be considered as one of the factors governing the selection of equipment.

Obviously the crucible process of melting brass and copper alloys affords the greatest possible flexibility in the point of number of different alloys that can be produced at the same time with exactly the same equipment. For instance, with one set of ten pit fires, representing an investment of approximately $2,000, copper, brass, bronze, nickel alloys, etc., can be melted at the same time and with an average production per 10-hour day of 8,500 lbs. With a type of electric furnace that will melt the same variety of products that can be made in the crucible, and representing an investment of about $10,000, an average production of 10,000 lbs. per 10-hour day may be expected, but the variety of alloys that can be made at the same time is greatly limited and in order to keep the melted cost within reason, lots of at least 1,000 lbs. must be handled.

In considering the installation of the crucible process the idea seems to obtain universally that coal pit fires must be used with the accompanying rather high labor costs, ash treating plant, heat and hard work. It is fair to say that gas fired crucible practice offers more general all around advantages than any other method of melting. On very large production of standardized alloys it is probable that the application of electricity with a good furnace would show greater economies, but for the flexibility required in the average brass mill casting shop or foundry and for miscellaneous work, gas fired crucible furnaces are eminently satisfactory. Lower labor costs result from the elimination of coal handlers, firemen, ash handlers, and the fact that the spilled metal falls into a clean pit does away with the necessity for ash treating, etc. There are further economies resulting from faster melting, less wear and tear on crucibles and better control over the heats. In fact, all the well recognized advantages of the crucible process are retained with less than half its disadvantages.

The real difficulty in selecting equipment of this kind lies in getting accurate knowledge of all the factors involved. Once these are known, and their relative importance determined, the selection of a furnace, fuel or process is comparatively simple. Comparative cost figures showing the cost of casting with one type of installation as against another, are not the only item of value. For instance, it may be stated that casting costs in one plant average 1½ cents per pound with a coal fired crucible outfit, while in another plant they are 1 cent a pound with an electric installation. Such a comparison does not by any means take into consideration all the factors involved; the relation of the casting shop or melting department to the rest of the plant equipment and the handling of the product, the requirements of the business and the development of new lines, the attitude of the plant organization. All of these are important and should certainly not be neglected.

It cannot be urged too strongly upon prospective purchasers of equipment for melting and casting, that the decision should be based upon the combined opinions of the metallurgist, engineer and production chief, with due consideration being given to the possible effect on the business policy.

ERRORS

On page 30 of our January issue there was an unfortunate typographical error in C. H. Proctor's article. The sentence which read " * * * some foreign cyanides appeared in the American market, but they were low in quality and high in price compared with the quality of American made sodium cyanide, 96-96% cyanogen," should have read "* * * American made sodium cyanide 96-98%, cyanogen 51-52%."

On page 7, in the short article on Hardness of Rolled Brass, by L. J. Krom, the eighth and ninth lines from the bottom, second column, should have read as follows:

The reduction of four numbers is known as hard.

The reduction of six numbers is known as extra hard.

Black Nickel Solutions

A Description of the Experiments Performed, and the Results Obtained in Depositing Black Nickel Without the Use of Copper, Arsenic or Sulpho-Cyanate Salts. Part 2†

Written for The Metal Industry by JOSEPH HAAS, Jr.*

For the purpose of gaining a still greater conception of the formation of the black deposit it was decided to vary one of the constituents and keep the others constant.

TABLE II

EFFECT OF INCREASE IN CONCENTRATION OF THE DOUBLE NICKEL SALT. VOLTAGE 0.5-0.75.

Solution.	Nickel Salts.	Rochelle Salts.	Zinc Sulphate.	Sodium Sulphate.	Remarks.
No. 1	4 oz.	½ oz.	½ oz.	2 oz.	Light brown deposit.
No. 2	6 oz.	½ oz.	½ oz.	2 oz.	Dark brown deposit.
No. 3	8 oz.	½ oz.	½ oz.	2 oz.	O. K. black.
No. 4	10 oz.	½ oz.	½ oz.	2 oz.	O. K. black.
No. 5	12 oz.	½ oz.	½ oz.	2 oz.	O. K. black.

From table No. II it can be seen that a concentrated solution is more favorable to the formation of nickel sulphide. That is because in dilute solutions, the nickel salt, ionizes differently than in concentrated solutions. In dilute solutions there are present very many nickel ions, which condition is unfavorable for the deposition of black nickel. The ionization of the double salt is:

$$(NH_4)_2\,Ni(SO_4)_2 = 2(NH_4)^+ + Ni(SO_4)_2^- \quad (1)$$

$$Ni(SO_4)_2 = Ni^{++} + 2(SO_4)_2^- \quad (2)$$

In dilute solution equation (2) predominates, while in concentrated solutions equation (1) does.

TABLE III

EFFECT OF INCREASING CONCENTRATION OF SODIUM SULPHATE. VOLTAGE 0.5-0.75.

Solution.	Double Salts.	Rochelle Salts.	Zinc Sulphate.	Sodium Sulphate.	Remarks.
No. 1	12 oz.	½ oz.	½ oz.	0	O. K. black; formed slowly
No. 2	12 oz.	½ oz.	½ oz.	1	Black; slow
No. 3	12 oz.	½ oz.	½ oz.	2	Black; quicker than in 1 or 2
No. 4	12 oz.	½ oz.	½ oz.	3	O. K. black
No. 5	12 oz.	½ oz.	½ oz.	4	O. K. black
No. 6	12 oz.	½ oz.	½ oz.	6	O. K. black

Though sodium sulphate need not necessarily be present to produce a black, its presence aids in the more rapid production of it. This lead us to the:

FUNCTION OF SODIUM SULPHATE.

That sodium sulphate is the best substance to add to increase the rate of deposition at the cathode was concluded from experiment No. 12, table I, where sodium chloride had been added. It might be said that the addition of sodium sulphate merely increases the conductance of the solution. If such were the case, then sodium chloride would act in the same way. But no, as experiment No. 12 showed, that when sodium chloride was used then the amount of zinc had also to be increased. Rather is it better to look upon sodium sulphate, that while it might increase conductance, that it decreases the tendency of the ion $Ni(SO_4)_2$— to ionize according to a well-known chemical law. In this way nickel ions are still further removed from the solution. That a decrease in the ionization of $Ni(SO_4)_2^-$ is caused by the addition of sodium sulphate, is believed to be the true function, as with increasing amounts of sodium sulphate, the voltage that the solution could be operated with also increased, reaching, in the case of solution No. 6, table III, 1.4 volts.

There was no trouble encountered by the increased concentration of zinc sulphate, provided the voltage was kept between 0.5-0,75. But, on using a voltage of 1.00, if the articles were left in the solution much longer than necessary to be deposited with nickel sulphide, they would turn grey along the edges. Consequently, there being no advantage of having a high concentration of zinc sulphate, the use of it was restricted to ½ oz. per gallon.

TABLE IV

EFFECT OF INCREASING CONCENTRATION OF ZINC SULPHATE. VOLTAGE 0.5-0.75.

Solution	Double Salts.	Rochelle Salts.	Zinc Sulphate.	Sodium Sulphate.	Remarks.
No. 1	12 ozs.	½ oz.	½ oz.	2 ozs.	O. K. black
No. 2	12 ozs.	½ oz.	1 oz.	2 ozs.	O. K. black
No. 3	12 ozs.	½ oz.	1½ ozs.	2 ozs.	O. K. black
No. 4	12 ozs.	½ oz.	2 ozs.	2 ozs.	O. K. black

MANIPULATION OF THE SOLUTION

For polished or bright appearance of black, articles of brass and steel may, if so desired, be plated in a nickel solution for 10-15 minutes and then transferred to the black nickel. It was stated that the solution should be operated at 0.5-0.75 volts when the anode and cathode are at a distance of 3½ inches. With greater distance between anode and cathode a larger voltage may safely be used. Work may be plated at 1½ volts, provided that it is immediately removed when the black is formed, otherwise a grey tone will develop which will gradually spread over the entire cathode surface. The safety limits of 0.5-0.75 were given only when it is impossible to watch the plating and when it is desired to give a heavy coating of black. In such cases it is possible to plate for one hour without the deposit turning grey. It is best to allow the deposit to form slowly. That the deposit is progressing well is indicated by an iridescent coloration that does not cover the entire surface of the articles, next the appearance of blue colors of varying intensities, and lastly the black. Brass, bright dipped, brass and steel sandblasted, are also given a jet black deposit in this solution. The work should in all cases be lacquered, not only to prevent action by the air, but also to improve the appearance of the deposit.

In the operation of the solution it is necessary to have clean rods, anodes and anode hooks.

Old nickel anodes are better than new ones, as they are more readily soluble; the more anodes used the better.

A deposit that forms slowly—that is, if after twenty minutes, only a brown coloration exists, indicates that the current strength is too weak; that the rods are dirty, or too weak zinc concentration.

A grey deposit indicates that too high a voltage has been used for too long a time, and never indicates that the solution contains too much zinc.

The solution should work at a temperature not lower than 70° F., preferably at 80° F.

SUMMARY

1. A black nickel sulphide—NiS—is obtained from a solution composed of:

Water	1 gallon
Double nickel salts	12 ozs.
Zinc sulphate	½ oz.
Sodium sulphate	2 ozs.
Rochelle salts	½ oz.

operated best at 0.5-0.75 volts when the electrodes are at a distance of 3½ inches. Current density 1 ampere per square foot.

2. The black deposit is obtained through the presence

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†For Part 1, see THE METAL INDUSTRY, January, 1921.

of zinc sulphate; that is, the zinc ion, and its excess over that of the formula is not injurious.

3. Sodium sulphate aids in the more rapid production of the black deposit.

SOLUTION IV.

Although, as has been shown under solution No. 3, black nickel is deposited without the assistance of a sulpho-cyanate salt, the possibility of the question arising, that the black deposit is not entirely formed by the presence of a zinc salt alone, but also due to the fact that the solution also contains sulphur in solution from both the nickel salts and sodium sulphate, has also been considered. Therefore, further experiments have been performed to prove that zinc salts alone are the cause of the black deposit. In the following solution, arrived at after considerable experimenting to have a properly balanced solution, no salts are used that contain sulphur as a part of their composition.

Water	1 gallon
Nickel chloride	6 ozs.
Ammonium chloride	6 ozs.
Sodium chloride	2 ozs.
Rochelle salts	1 oz.
Zinc chloride	¾ oz.

The ingredients when dissolved must first be boiled with nickel carbonate before the solution can be used to best advantage, and only the clear solution used after remaining carbonate has been allowed to settle. Unless this is done the deposit would be considered unsatisfactory, as a fine powdery deposit is formed on top of an adherent black deposit. This powdery deposit can be wiped off, revealing an adherent deposit underneath. This, for commercial purposes, is undesirable. It is believed that this powdery deposit is caused by the hydrolysis of both nickel chloride and zinc chloride resulting in the formation of acid which causes the powdery deposit. More so is this believed to be the case, as boiling with nickel carbonate eliminates this objectionable feature.

The solution is operated from 0.5-1.00 volts; electrodes 3½ inches apart; current density 1-2 amperes per square foot. The deposit obtained from this solution is jet black, and is believed to be nickelic hydroxide $Ni(OH)_3$.

THEORETICAL DISCUSSION

Blackish deposits may be deposited from a solution that contains nothing more than single salts and zinc sulphate. The higher the concentration of the nickel sulphate the blacker the deposit. That proves that to deposit black nickel, nickel ions must be of low concentration. But, at the best, a deposit from such a solution cannot be called really black, and the working of the solution is erratic.

So, with this chloride solution, first attempts to use only nickel chloride proved unsuccessful, in that a real black could not be obtained. A complex salt was found to be necessary. It is for this reason that ammonium chloride is a part of the formula, to form the complex salt $NH_4NiCl_3^-$ ammonium nickel chloride.

The electro-chemical reactions that take place are not so clear as those that take place in solution No. 3, but the following are suggested as those that possibly occur:

$$NH_4NiCl_3 = NH_4 + NiCl_3$$
$$NiCl_3 + 3H_2O = Ni(OH)_3 + 3HCl$$
Black

In other words, these reactions are interrupted so that the ammonium nickel chloride is dissociated into the ions, ammonium (NH_4+) positively charged, and nickel chloride ($NiCl_3—$) negatively charged, and under the influence of the electric current and catalytic influence of the zinc ions in the solution, the nickelic chloride reacts with water forming nickelic hydroxide which carries a positive electric charge and is consequently deposited upon the cathode.

CONCLUSION

Where it is desired or requisite that a black finish be produced on steel, which should have also rust-proof qualities, the steel should first be zinc plated and then the black nickel deposited. The character of the black upon zinc plated articles will vary according to the mechanical treatment given the zinc plate. High polished steel, zinc plated and then colored, will give as lustrous and deep a black as on brass. Polished steel, zinc plated and scratch brushed, will give a semi-lustrous black, while if the brushing is omitted and the steel transferred from zinc solution to black nickel, a dull black will be obtained.

Solution No. 3 has been in commercial operation for a year and a half. Solution No. 4, eight months. They have been operated in accordance to the principles here laid down and maintained and replenished on the same principles and are giving uniform and constant results.

Copper Plating

By CHARLES H. PROCTOR

Q.—We are having trouble with our still copper solution plating on steel stampings. The solution is made up as follows: Water 1 gal., carbonate of soda ¼ lb., carbonate of copper ¼ lb., sodium cyanide ½ lb., hyposulphite 1 oz. per 100 gal.

a. Using 2½ volts and letting work plate from 10 to 20 minutes we get a clear, fairly bright copper plate; but upon using a higher voltage or allowing 1 hour or more to plate, the copper plate blisters. The above solution is used at 70 degrees.

b. What advantage is there in using copper cyanide?

A.—The metal content of your copper solution is low for cold solution. If the solution were heated to 120 to 140 deg. Fahr., the results would be much better.

Add sodium bisulphite to the solution to overcome the blistering upon the basis of one ounce per gallon; more if required. Then add a little more free cyanide, ½ ounce per gallon.

Copper cyanide and copper carbonate give identical results, but copper cyanide costs less to put in solution, based upon the metal content. In other words the saving is made upon the amount of sodium cyanide used. For instance the solution you are using is made up as follows:

Water	1	gal.
Sodium Cyanide	8	ozs.
Copper Carbonate	4	ozs.
Carbonate of Soda	4	ozs.
Hyposulphite of Soda	4½	grains.

It contains 2 ozs. of metal, based upon 50 per cent metal, which copper carbonate contains.

As copper cyanide contains 70 per cent metal, then the following formula gives better results:

Water	1	gal.
Sodium cyanide	3¼	ozs.
Copper cyanide	3	ozs.
Bicarbonate of soda	1	oz.
Bisulphite of soda	½	oz.
Hyposulphite of soda	5	grains.

However, when copper solutions are used, cold, the proportions given should be increased 50 per cent or more. The solution should be prepared by taking one-third of a gallon of hot water and dissolving the cyanide therein, and after that the copper cyanide. Then add the other two-thirds of the water cold, to make up the gallon basis. Then add the soda salts in the order given, stirring constantly until dissolved. The solution is then ready for use at 2½ to 4 volts.—C. H. P.

Electro-Deposition and Electroplating

A Symposium and General Discussion Held at a Joint Meeting of the Faraday Society and the Sheffield Section of the Institute of Physics on Friday, November 19, 1920, in the Mappin Hall of the Department of Applied Science of the University of Sheffield

The afternoon session, which was presided over by **Professor C. H. Desch, D.Sc.,** was devoted to problems relating to Electro-deposition generally.

Dr. Leslie Aitchison presented a paper on **"Electroplating for the Prevention of Corrosion,"** which was communicated by **Mr. W. R. Barclay.**

The paper dealt more especially with the protection of iron and steel and their alloys. The conditions for proper protective coatings, namely, permanence and resistance and non-permeability to corrosive agents, were defined and the value of the various protective coatings discussed with relation thereto. In particular, the relative advantages of hot coating and cold electro-deposition were considered and the general advantage of zinc deposition over galvanising was emphasized.

The properties required in a metallic protective coating were classified as follows:—

1. Uniformity.
2. Permanence.
3. Good appearance.
4. Freedom from porosity.
5. Freedom from pinholes.
6. Good adhesion to base metal.
7. Reasonable ductility.
8. Freedom from scaling or flaking.
9. Penetration into all parts of a complicated surface.
10. Minimum tendency to promote corrosion of the base metal if the coating is pierced.

Special emphasis was laid on the need for ductility and condition 10 was discussed and some apparent anomalies set forth. Preparation of the surface was dealt with.

Mr. W. R. Barclay entirely agreed with the necessity for the bend test for engineering products. The advantages of cold electrolytic deposits over hot galvanized ones was unquestionable. A thin electrolytic coating of zinc was a more efficient protection than one four or five times as thick due to hot galvanizing.

Mr. S. Field urged the necessity for using pure zinc in cold galvanizing. Impurities led to brittle deposits.

Dr. W. H. Hatfield expressed his surprise at the small amount of tin used in a South Wales tinplate works to give a perfectly adherent coating.

Mr. W. R. Barclay in reply to the discussion referred to experiments in progress for solving the problem of brittleness.

Professor C. H. Desch said that the sherardizing process could apply thin and efficient coatings. On the Clyde the electro-galvanizing of ship's parts was common.

Mr. W. A. Thain, A.M.I.C.E., read a paper entitled **"Some Applications of Electro-deposition in Aeronautical Engineering."**

Three cases of the electro-deposition of copper were considered, viz.: (i) as a protection against carburization in case-hardening practice; (ii) as a means of increasing heat conductivity; (iii) as a means of building up a definite constructional detail.

As an example of (i) the treatment of a camshaft was considered. In case (ii) copper-plating of the steel cylinder of an aeronautical engine was examined. The deposit is of the order of 0.003-inch thick, being greatest at the top of the flues and least at the foot. Finally an account was given of the details in the building up of the copper water jacket of a Beardmore aero-engine cylinder. The final thickness of the jacket wall is 1.7 mm.; it is tested under water pressure of 25-30 lbs. per sq. inch, and as hundreds of such cylinders had stood the test of active service, the method had been thoroughly proved and must be considered a sound practical proposition.

Mr. Byron Carr read a paper on **"The Electro-deposition of Cobalt."**

From a bath containing 4½ lbs. of cobalt sulphate crystals, 5½ ozs. boric acid and 2½ ozs. of sodium chloride per gallon and used at 34° C., excellent hard adherent deposits of cobalt were obtained, provided that these were not too thick, with 150 and 72 amperes per sq. foot respectively. Periods of immersion not exceeding 2 and 4 minutes respectively were suitable. The deposit is exceedingly resistant to atmospheric corrosion and is superior to nickel in the rapidity of deposition and hardness. Articles of domestic use so treated were, however, subject to the deleterious action of fruit juice.

Mr. W. E. Hughes, B.A., presented a paper on **"The Use of Colloids in the Electro-deposition of Metals."**

Colloids and substances producing the same effects were often usefully employed in electroplating solutions. In one case at least—that of lead—no coherent deposit could be obtained unless some colloid, for instance, glue or peptone, was used. The effect usually produced by the colloid addition was a diminution of the size of grain of which the deposit consists, the diminution being, in some cases, so extreme that, to the naked eye, the deposit appears plastic and non-crystalline. The mechanism of the change from macro-crystalline to micro-crystalline was unknown. The differing views of Marc, Kohlschütter, and Freundlich and Fischer were referred to, and it was suggested that this difference of opinion was in itself sufficient reason for drawing attention to the operation of colloids in plating solutions, which was of interest both practically and theoretically.

Mr. S. Field, A.R.C.Sc., read a paper on **"The Commercial Electrolysis of Zinc Sulphate Solutions."**

The electrolysis of zinc sulphate solutions is carried on commercially in cold galvanizing with a zinc anode, and in the electrolytic recovery of zinc, using an insoluble lead anode. In the latter case the solution contains a percentage of acid prior to electrolysis, and this increases as the zinc is deposited, usually on aluminium cathodes. A neutral sulphate solution containing 10 per cent of zinc may be produced by leaching ores or other zinc-bearing materials with sulphuric acid or acid zinc sulphate liquors from the electrolytic cells, and this composition may conveniently be altered to 8 per cent zinc and 3 per cent acid before electrolysis. Commercial electrolysis aims at the maximum extraction of zinc from such a liquor with a minimum of energy. The greater the extraction of zinc, the smaller the volume of liquor which circulates through the whole of the extraction plant, and the smaller the proportion of zinc which demands repeated purification. A limit to this extraction is set by the cost of increased energy necessary to take out zinc from dilute liquors, due mainly to a considerable falling off in the current efficiency. Current efficiency is dependent upon a number of factors including current density,

amount of zinc present, temperature, and last, but by no means least, the presence of impurities.

Several impurities normally occurring in these crude zinc sulphate liquors exert a marked deleterious effect on the deposition of the metal from these acid solutions. The effect of, among others, nickel and cobalt has been carefully studied. The presence of a few parts of either of these metals per million parts of liquor disastrously lowers current efficiency and increases energy consumption. Traces of cobalt produce an extraordinarily honeycombed deposit, while even smaller amounts of nickel produce large and clean-cut holes in the deposited metal. The types of corrosion exhibit a marked contrast.

Traces of these impurities thus seriously militate against successful deposition. Neither impurity is deposited with the metal but remains in the solution and, concentrating during the cycle of operations, soon places the operation outside the sphere of economy. Colloids have an ameliorating effect, but of a temporary character only. The elimination of these impurities is an essential to successful deposition.

It is suggested that as the beneficial effects of traces of colloids are known and applied there is justification for keeping a close watch on all impurities in electro-depositing solutions even though the normal conditions of deposition may widely differ.

The evening session was presided over by Mr. E. A. Smith. The papers presented all dealt with various aspects of the electroplating of silver.

Mr. W. R. Barclay, O.B.E., A.M.I.E.E., read a paper on **"Electro-Silver plating and its Technical Development."**

This paper dealt with the history of technical investigation, and research into the electro-deposition of silver, so far as the more practical aspect of electro-plating is concerned.

The work of early authorities, such as Smee, Gore, Langbein, and others, was briefly outlined, but it was pointed out that the main advances belonged to the last twenty-five years, and followed on the work of the physical chemists of the latter part of the nineteenth century, who laid the foundations of modern electro-chemistry.

The investigations of such research workers as Brunner, Foerster, Bancroft, Frary, and Porter, and others, on the influence of current density, metal and free cyanide concentration, and other cognate factors, on the character of silver deposits was discussed, and an outline given of the author's own experience in workshop practice.

Emphasis was laid on the necessity for careful coordination of the factors of metal and free cyanide content to that of current density. It was shown that though considerable latitude is allowable in practice, the best results and highest efficiency lie within fairly well-defined limits. With a current density of 2.75 to 3 amperes per square foot (for example) a solution containing 3 troy oz. per gallon with not less than twice a molecular equivalent of free cyanide, gave excellent results as to both quality of deposit, efficiency, and time occupied.

Among other matters it was pointed out that silver solutions in existence over sixty years still continued to yield excellent results, and that generally old solutions yielded better deposits at higher current densities than those newly made up from pure materials. Recent investigations had shown that this was due, in a great measure, to the presence of substances other than the simple double cyanide of silver and potassium, especially potassium carbonate, which salt is usually to be found in a higher proportion than any other, and increases the conductivity to a considerable degree.

While the technical efficiency of a modern silver-plating plant was fairly high, further investigation was necessary as to the exact influence of substances such as potassium chloride, sulphate, cyanate, and formate, all of which had been shown to be present in commercial plating baths, and necessarily made the chemical and electro-chemical reactions of these baths somewhat complex. A question of further importance remaining to be solved was the influence of organic matter on the physical structure of deposits.

Mr. G. B. Brook, F.I.C., and **Mr. L. W. Holmes**, presented a paper on **"The Chemical Composition of Old Silver-plating Solutions, with Observations on their Working Properties."**

The paper dealt with a large number of solutions varying in age from one to fifty years, furnishing historical, chemical, and physical data with regard to each, and correlating the composition with the working properties in actual works practice. The graph showing the intimate relation of the carbonate content to the electrical conductivity was the outstanding feature of the paper, and constituted in itself a valuable discovery, which promised to have a far-reaching effect on the composition of the plating solution of the future. The comparison of solutions, used respectively by "trade" platers and private manufacturers' plating departments, was of considerable interest.

Mr. Frank Mason, A.M.I.E.E. presented a paper on **"A New Maximum Current Density in Commercial Silver-Plating."**

The point of Mr. Mason's discovery was the rapidity with which quick plating was done without the risk of "burning." According to the present practice in the trade, the rapidity with which the deposition of the silver on any article being electro-plated is made depends on the strength and quantity of the electricity put into the chemical plating bath. If the electric current is increased beyond a given standard, the "plate" is burnt, although the plating is more rapid. In his process, by varying the chemical composition of the plating bath or electrolyte, it is possible not only to more than double the current of electricity, and thereby make it work twice as quickly as by the present practice, but to get a "plate" of the best. He effected this by increasing the amount of free cyanide. A solution which plated 8,000 ounces of silver analyzed as follows:

Silver.....grammes per liter	26.14
Free KCN.....	47.25
Potassium carbonate.....	165.00

Mr. A. Bowker maintained that no plater could double his output by simply doubling his current density as the latter was only one factor. The time of preparation of the article was an important consideration. A great objection to the high current density advised by Mr. Mason lay in liability to "overweight," which was dead loss to the plater.

Mr. Price said he had deposited silver at the rate advocated and he advised platers to show more courage. He had covered his anodes with felt and brought them nearer to the cathodes, thus enabling a higher current density to be used.

Mr. W. R. Barclay regretted that both Mr. Mason and Mr. Brook had not referred to earlier work. Brunner had used current densities up to 12 amperes per square foot and obtained good deposits, and he (Mr. Barclay) had pointed out the importance of potassium carbonate in 1912. He considered that it was not only the potassium carbonate but all the potassium salts present which influenced the result.

The Effect of a Tariff on Graphite

What This Will Do to Some Manufacturing Industries

Written for The Metal Industry by JONATHAN BARTLEY

Mr. Bartley who has been known to foundrymen for years can speak with authority on this subject. His record as superintendent for Joseph Dixon Crucible Company, Jersey City, N. J., founder of the Jonathan Bartley Crucible Company, Trenton, N. J., president of the Bay State Crucible Company, Taunton, Mass., and builder of the Chicago Crucible Company, Chicago, Ill., has given him a most comprehensive knowledge of graphite as a foundry material.—Ed.

At the second session of the 66th Congress on January 16, 1920, a bill was introduced by the Honorable Joseph W. Fordney, of Michigan, for the purpose of placing a tariff on graphite. Said bill was referred to the Committee on Ways and Means, and it is generally understood that it will be acted upon during the present, or the next session of Congress. It is known as bill H. R. 11815, and is offered "to provide for the national security and defense by encouraging the production and refining of graphite (plumbago, silver lead) ores in the United States."

If these two objects could be accomplished without sacrificing other American industries whose monetary, commercial and industrial interests are of a much greater value, every patriotic American would join hands in asking that the bill be made a law, but if it is a bill that threatens other long established industries, and levies an unjust tax on our people as a whole, it is not only our privilege, but our **duty** to protest against it.

It is the purpose of this article to point out that a tariff on graphite will not only be detrimental to many large manufacturing interests in this countr, but I shall endeavor to show that it **will not** afford any **protection** to the graphite mining interests in the United States. In order to do this I shall make brief mention of some of the uses for which graphite is essential:

Crucibles, lubricants, polishing, pencils, foundry facings, electrical purposes.

Although various other uses are made of graphite, these comprise the most important ones, and I shall use them in my effort to demonstrate what the effect will be on the manufacturers of these products by the placing of a tariff on this important commodity.

The introductory paragraph in the pamphlet, entitled "Information Concerning Graphite," which was printed by the Government for the use of the Committee on Ways and Means, reads: "In the graphite industry interest **centres** in the material capable of being made into crucibles," and inasmuch as fully 60 per cent by weight and 90 per cent in value of all the graphite imported into the United States coming from Ceylon is made into crucibles, I shall present some facts concerning their manufacture, beginning with the statement that IT IS IMPOSSIBLE TO MAKE A SERVICEABLE CRUCIBLE FROM AMERICAN GRAPHITE ALONE, and follow this by saying that ONLY A VERY SMALL PROPORTION OF DOMESTIC GRAPHITE CAN BE USED IN THE VARIOUS CRUCIBLE MIXTURES WITH ANY DEGREE OF SAFETY.

These strong statements are backed up by the writer's long experience in the crucible business together with records that cover a period of seven consecutive years' work in the effort to find out just how much domestic graphite could be used safely to make a good crucible. The "trial balance" shows that 10 per cent was the maximum in sizes most common in foundry work. It is true that some of these records show a few fairly favorable tests on the smaller sizes, and also in some larger sizes where low fusion was required, but the use of small crucibles is so limited and the low fusion element so rare that their calculation towards an average would be very misleading.

There is a very pronounced difference in the physical properties between the American and Ceylon flake. The American is very much thinner, more flat on the surface, and lighter in specific gravity than the Ceylon variety. The Ceylon product is more cubical in form and carries a greater surface area in proportion to its volume. The American flake gathers and holds air to such an extent that it will not resist pressure, and it is impossible to press it into a form that can be retained without an excessive amount of binder. It requires fully 10 per cent more clay binder to produce a mass of equal density with the Ceylon, and herein lies the greatest danger.

The crucible maker aims to use the minimum amount of clay possible for two reasons: first, because of its slow conductivity, and second, because of its readiness to absorb moisture, thus increasing the tendency to crack under the expansion and contraction conditions it is exposed to in service. On account of this physical difference, American flake cannot ever be made a competitor with Ceylon in the making of a graphite crucible.

From these facts it can be seen that to maintain the present standard of efficiency in the graphite crucible it will be necessary to use the Ceylon product regardless of whatever tariff may be imposed on it, and the injustice of such action not only affects the crucible industry, but it affects hundreds of other important manufacturing interests where the graphite crucible is an important adjunct. There are thirteen crucible plants in operation today in the United States, and if this bill becomes a law it means an assessment of approximately $2,000,000 on these plants, which, in turn, must pass it along to the thousands of crucible users. From these it goes to every commercial industry either directly or indirectly, and stops only at every household throughout our land. Most of the crucible plants in operation have been long established. All of them furnish employment to hundreds of people. Millions of dollars are invested in their equipment, and it certainly is far from American principle to enact any law that not only endangers, but is almost certain to destroy this particular line of industry.

Then, too, there is another factor to be considered. The electric furnace is becoming a strong competitor of the crucible. During the war period the high cost of graphite, due to embargoes, excessive freight and insurance charges, made it necessary for the crucible maker to advance the price on crucibles proportionally, and it was the price of 16 cents per number that gave incentive to inventors to produce something to take the place of crucibles in order to lower the cost of production. Just how far the electric furnace will ever become a formidable competitor of the crucible cannot now be predicted, but we do know that several of the large melters have them installed, and I believe their future depends very largely on the price of crucibles.

These are the plain unvarnished facts as concerns the effect of a tariff on graphite to the crucible trade, and from these facts one can readily see that the passage of

this bill will not only bring disaster to the crucible industry and seriously affect many other branches of trade, but it WILL NOT afford any PROTECTION to the American miner of graphite.

PENCILS

Inasmuch as amorphous graphite is used almost exclusively in the manufacture of pencils, and the provisions in this bill carry no duty on this variety, there will be little effect one way or the other. The American type of amorphous graphite is too low in quality to be of use in this line. Some Ceylon graphite is used in making pencils for special purposes, but not to any great degree.

LUBRICATING GRAPHITE

For this class of work the American product is particularly adapted because of its thinness of flake. It is superior to Ceylon and much preferable to Madagascar; in fact, it has no competition as a lubricant. Very little of the imported is used for this purpose and therefore American flake needs no protection as far as its use for lubricating is concerned.

FOUNDRY FACINGS

The same reason that makes American flake undesirable for crucibles makes it undesirable for foundry facings. It is too light and fluffy, carries too little body to hold its place against the action of the molten metal. Being the by-product in the refining process to produce flake it abounds in impurities that are highly detrimental to a good facing, and it goes without saying that it would be grossly impracticable to use the higher grades for this purpose. We believe that every grinder of facing at the present time uses the American product to the limit, but he cannot produce a satisfactory facing with domestic graphite alone. This means that if this bill becomes a law he will be compelled to pay the duty and charge it to the user, or make an inferior product that will bring no end of trouble to the founder.

ELECTRICAL PURPOSES

It has been demonstrated by some of the largest manufacturers of electrical supplies that the American graphite has no standing with the Ceylon product for the density required. It cannot be pressed and HOLD its shape without a large amount of binder, which shows plainly that it is useless for electric purposes. In this growing industry there will never be any great demand for American graphite.

FINAL

The mining of American graphite cannot, and will not, be stimulated or advanced by any tariff placed on the imported. Outside of its use as a lubricating product, it will never take a foremost place in the manufacturing world, and its future cannot be anything but a repetition of its past history, a promoting debauch that will cost hundreds of thousands of dollars to the innocent investor just as it has in the past. Professor Bastin, in one of the U. S. Geological Reports, remarks: **"Today there are more abandoned graphite mines and mills in the United States than the number in operation. In the number of times some of these properties have changed hands in the course of a few years, there is a record of misrepresentation and disappointment that can hardly be equalled in any other branch of mining, and many properties have been notoriously associated with stock manipulations of doubtful character."**

Is Cleaning an Essential Manufacturing Operation?

One of the Prize Winners in $500 Prize Story Contest of the Oakley Chemical Company Writes from Experience and Tells Why He Believes Cleaning Is an Essential Manufacturing Operation

By OSCAR A. HILLMAN

During the past twelve years I have answered several thousand questions for the technical press relative to cleaning, plating, and plating troubles, in addition to handling over a thousand questions each year in my positional capacity, and as over 60 per cent of a plater's troubles are caused by improper cleaning, I can testify to the fact that cleaning is an essential manufacturing operation.

A simple way to prove how serious a problem cleaning is, and how little the problem is understood by platers in general and nickel platers in particular, is to examine ten different articles that have been subjected to ordinary wear for even a short time in any household and it will be found quite impossible to look over ten articles such as a gas range, electric flat iron, telephone, etc., without finding places where the nickel has peeled. Every housewife is disgusted with a range when the nickel begins to peel; every man loses interest in his auto as soon as the trimmings show brass spots, and it certainly would be hard to find a boy or girl that took much pride in a pair of skates if the nickel tore off in sheets the first time they were sharpened. So it is easy to see that the reputation of an article and the satisfaction of owning it is vitally affected by the way it was prepared for finishing.

The old-fashioned soaps and lyes that were so effective in removing polishing compositions when the compositions were made up with animal fats for a binder, are almost useless at present as the compositions now on the market almost invariably contain paraffine, mineral oils and waxes that require special treatment. The dangerous and expensive method of removing heavy oils, compositions, etc., by using gasoline cannot be resorted to, as the commercial grade of gas contains considerable mineral oil which is a prolific source of trouble in itself and the high cost makes its use prohibitive.

Electric cleaning is advisable for some classes of work, but for the ordinary run of work agitating the solution by boiling or by keeping the work in motion by mechanical means is sufficient. The facts I wish to emphasize are: (1) It is an incontrovertible law that in order to obtain deposits that will not peel, it is necessary to start the deposit on a chemically clean surface; (2) cleaning and plating have passed the guesswork stage and there is no excuse for the deposit peeling or stripping; (3) when a few pieces of work from a batch strip during the finishing, it is safe to assume that a large percentage of the articles will strip after a few weeks' wear, even though they may appear to be satisfactory when new, and (4) in spite of rising costs and the fact that manufacturers and employees are confronted with new and complex cleaning troubles, scientific cleaning can be accomplished cheaper, faster, and more efficiently than ever before. There is absolutely no more need for worry over cleaning than over drying or any other simple operation, provided the proper equipment is installed and a cleaning material used that is adapted for the work in hand.

THE METAL INDUSTRY

With Which Are Incorporated

THE ALUMINUM WORLD, COPPER and BRASS, THE BRASS FOUNDER and FINISHER, THE ELECTRO-PLATERS' REVIEW

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Contents

The Right Molding Machine 61
The Essential Features of a Good Molding Machine for the Brass Foundry.....By WILLIAM H. PARRY.

Practical Foundry Mixtures 63
By F. W. LOLL.

Monel Metal 64
A Summary of the Properties, Methods of Melting and Casting, Uses, Handling and Working in Up-to-date Practice, of this Natural Nickel Alloy. Part 2.....by ADOLPH BREGMAN.

Anti-Friction Bearing Metals 66
Chemical, Physical and Thermal Review..By P. W. PRIESTLEY.

Some Properties of White Metal Bearing Alloys at Elevated Temperatures 68
By JOHN R. FREEMAN and R. W. WOODWARD.

Molding for Yellow Brass 68
By W. J. REARDON.

Ferric Sulphate as a New Etching Re-Agent in the Metallography of Aluminum 69
A Description of the Uses of Aqueous Solutions of Ferric Sulphate for Distinguishing $CuAl_2$ and $FeAl_3$
By ROBERT J. ANDERSON.

Tinning Copper 70
By L. J. KROM.

Deposition of Metals on Wax 71
A Compilation of Some of the Methods and Processes Used.
By SAMUEL WEIN

Casting Shop and Melting Room Equipment 72
By EQUIPMENT ENGINEER.

Errors 72

Black Nickel Solutions 73
A Description of the Experiments Performed and the Results Obtained in Depositing Black Nickel Without the Use of Copper, Arsenic or Sulpho-cyanate Salts, in Two Parts. Part 2.
By JOSEPH HAAS, Jr.

Copper Plating 74
By CHARLES H. PROCTOR.

Electro-Deposition and Electroplating 75
A Symposium and General Discussion Held at a Joint Meeting of the Faraday Society and the Sheffield Section of the Institute of Physics on Friday, November 19th, 1920, in the Mappin Hall of the Department of Applied Science of the Universary of Sheffield.

The Effect of a Tariff on Graphite 77
What This Will Do to Some Manufacturing Industries.
By JONATHAN BARTLEY.

Is Cleaning an Essential Manufacturing Operation 78
One of the Prize Winners in the $500 Prize Story Contest of the Oakley Chemical Company, Writes from Experience and Tells Why He Believes Cleaning Is an Essential Manufacturing Operation .....By OSCAR A. HILLMAN.

Editorials 80
Alloys Research Association.
The Expert.
Tariffs.
Immigration.

Government Publications 81

Correspondence and Discussion 82
The Aluminum Industry.

Group Life Insurance 83

The Plating Industry 84

Shop Problems 85

Patents 87

Equipment 89
Unusual Welding Applications.
New Metal Cutting Machine.
New Testing Machine.
New Buff.
New Turbine.
New Cement for Brass Castings.

Associations and Societies 91

Personals 92

Deaths 92

Trade News 93

Secondary Metal Industry in the United States in 1919 98

Metal Market Review 101

Metal Prices 102

Supply Prices 104

EDITORIAL

ALLOYS RESEARCH ASSOCIATION

A most important step forward has been taken in the interests of manufacturers and users of metals, by the National Research Council, in the formation of an Alloys Research Association of which an Alloys Information Service is the first step. No one knows more than the manufacturer and metallurgist how valuable information can be. Fifteen minutes of reading may save a week of work. The cry has always been that it was impossible to obtain the necessary information, that it was too widely scattered, that it would take too much time and energy to hunt it up and that moreover it was in a number of different languages. It is obvious that to search through the hundreds of periodicals and technical society reports, to translate articles of interest which have appeared in foreign languages is an impossibility for the individual organization, unless it is extraordinarily large.

Heretofore, there has been no trustworthy, dependable agency to cover this whole field. Now, however, the information service bids fair to fill this need in a most satisfactory manner. It is planned to create a special scientific staff of a director and his assistants, who will give all of their time to this work, which will be divided into two parts: (1) Current Information Service—supplying information as to new results and (2) Reference Service—supplying as fully as possible all existing information relating to any phase of a subject.

The scope of the service is as follows:

(a) Regular summaries of technical information in the metal field, these being critical and analytical abstracts from a list of journals which shall be as extensive as possible, representing the world's literature on the subject.

(b) Concurrently with the abstract service, a reference service conducted to produce abstracts based upon the same list of journals, and, when obtainable, antedating the commencement of the abstract service.

(c) Copies of original articles, at the actual cost of blue-printing or photostating.

(d) Upon request, translations of technical articles on metals and related subjects, at cost.

The following functions also will be performed:

(e) A complete record of available data on alloys will be maintained, so arranged that desired information can be immediately located. This will take the form of a card encyclopedia, and upon such cards data will be presented in the form of graphs whenever possible.

(f) Questions will be answered in so far as the information is available in the literature.

(g) A collection of photomicrographs is to be assembled together with the interpretation of the observed characteristics.

(h) A special effort is to be made to collect information in advance of publication and to secure the co-operation of laboratories to release from their files the results of their researches which may not have been published, but which can be contributed to the Alloys Research Association without detriment to the best interests of the contributor.

(i) Monographs may be prepared on phases of needed research.

(j) A consistent effort to supply general information covering the metal field is to be maintained, using such mechanisms as may be approved by the Director of the Service and the Board of Managers.

In carrying out details of the informational service, emphasis will be placed upon:

(a) Physical and chemical properties of all alloys as functions of composition and previous treatment.

(b) Corresponding properties of all pure metals.

(c) Apparatus and methods used in the preparation of non-ferrous and ferrous alloys from their constituents, but not the preparation of metals from their ores.

(d) Methods and instruments used in measurement and analysis.

(e) Results from service tests of alloys.

Under paragraph (c) such apparatus as furnaces and furnace linings would be included as apparatus of direct interest. Methods, as distinguished from apparatus and machinery, would include information concerning electroplating, welding, casting, rolling, drawing, extruding, heat-treating and other processes.

Further information can be obtained from the Research Extension Division of the National Research Council, Washington, D. C.

THE EXPERT

It is the fashion nowadays to assert that the day of the specialist is here to stay and that no one can hope to know thoroughly more than a very small field. Even so, it is considered very difficult to achieve the rank of an expert and one of the favorite sources of amusement for the average man is ridiculing the pretensions of those who claim to be experts.

To the newcomer in any profession, the method of attack is simple. He will learn all about the business and then know it all. After he has tried this for a while he finds out that it is necessary for him to restrict his field of endeavors to the possible. His tendency is to go to the other extreme and to say, "I shall learn this or that and become an expert. I shall not bother with other things," but again he is forced to change his mind. He finds that he cannot truly understand his specialty unless he understands also its ramifications and its allied fields. The man who is designing a furnace must understand the principles of mechanical engineering, of steel construction as applied to his furnace, refractories and the metallurgy of the metals which his furnaces are to handle. Foundrymen should have a knowledge of alloying, melting, smelting, refining, molding, pattern making, and last but not least, since the introduction of electric furnaces, of electricity. The plater must understand electro-chemistry, have a knowledge of organic chemistry, at least, to the extent of the effect of colloids in his solutions and must know about japans, lacquers, varnishes and rust-proofing methods.

It has been found essential for the successful conduct of

any technical manufacturing work that an organization should understand not only its immediate work at hand, which is the manufacture of the product which it sells, but also the work of the industries which feed it and which it feeds. It must be able to check up its purchases to see that they are up to standard, and to follow its product into places where it is applied and assist in making its use successful.

To be sure it is no longer possible for one man to cover the whole range of knowledge. Nevertheless, it is equally impossible for him to carry on his work successfully unless he understands in addition to his own specialty, the work of those adjoining him.

TARIFFS

One of the questions of the hour (there are many), and perhaps the one which affects the metal industries most, is the tariff. In addition to the fact that a new administration is soon to come in, the present depression has revived the protectionists and now a measure is pending, which, if passed, will raise the imports on several metals.

Jonathan Bartley discusses the graphite tariff on page 77 of this issue, showing that it is a tax on a raw material which must be used and which cannot be replaced by an American product. Mr. Bartley has written the first word on the present tariff situation and our columns are open for opinions from all concerned with the metal industries. The proposed tariff on aluminum is opposed by the National Aluminum Founders' Association and a number of the smaller manufacturers and dealers. The National Automobile Chamber of Commerce recommends a reduction from 45 to 30 per cent in the duty on automobiles. A tariff on tin smelted abroad is also spoken of, but so far we have had no indications of the feeling about it.

It is a serious question whether "tariff for tariff's sake" will do us good or harm. It is a matter of balancing the benefits against the detriments and legislating for the greatest good of the greatest number.

IMMIGRATION

It seems that this is the time for all great minds to give to the aid of their country and to advise it from the fulness of their wisdom. Whether or not this always works out is a debatable question. One example of the difficulty which these minds have in getting along with each other is the question of immigration. On the one hand, we have Mr. Barr and the Inter-Racial Council, who demand that immigrants be allowed to come in any numbers. On the other hand, we have men like Frederick A. Wallis, U. S. Commissioner of Immigration, who has been credited with stating that we are in danger of being buried under a tidal wave of 25,000,000 immigrants.

It is a little difficult to imagine what our situation today would have been without the immigrants and their descendants who have been coming here for the last hundred years. Undoubtedly, we have them to thank to a great extent for our development. Industrially, we need them, perhaps not at the present moment, but certainly over any extended period. We have seen more than once the statement that the second generation does not produce enough labor for the country's needs and that this can be supplied only by immigrants. Aside from the question of living up to the original ideals of the Founders of the nation, that of providing a home and asylum for the oppressed, we have found that it is decidedly a paying business proposition to admit immigrants. Whether the time has now arrived to put up the bars is another question.

The New York State Chamber of Commerce recommends restriction for one year on the grounds that under the present conditions we cannot support any more people than we have, and that too many foreigners come here with ideas incompatible with those of America. It is, of course, an old story that election frauds in cities are helped by the ease with which the foreign vote can be collected and delivered. Politically, the immigrant is a serious problem. It would seem foolish to say offhand that we do not need his ideas, that everything we have here is as good as it can possibly be, and that we want no changes. There is no reason why foreigners cannot contribute to this country as well as receive its benefits, and if we do make a differentiation, it is hard to know where to draw the line of selection. This line will have to be drawn with utmost care, for the sake of our industries when they have passed through the present temporary lull, and to avoid doing injustice to those who are anxious to give us the best that they have. If the problem of distribution could be handled and immigrants kept from being crowded into the slums of a few large cities, a serious difficulty would soon disappear.

GOVERNMENT PUBLICATIONS

Lead in 1918.—General report by C. E. Siebenthal, U. S. Geological Survey, Washington, D. C.

Strontium in 1919.—G. W. Stose, U. S. Geological Survey, Washington, D. C.

Gypsum in 1919.—Ralph W. Stone, U. S. Geological Survey, Washington, D. C.

Sand and Gravel in 1919.—Ralph W. Stone, U. S. Geological Survey, Washington, D. C.

Safety and Health Almanac for 1921.—A pamphlet issued by the Bureau of Mines in co-operation with the U. S. Public Health Service, for the use of miners. This pamphlet includes a number of items of interest to metal plants, such as lead poisoning, tuberculosis, care and protection of the eyes, care of the teeth, prevention of malaria, etc.

Report on the Productive Industries.—A volume issued by the Bureau of Statistics and Information of Pennsylvania on the productive industries of that state.

CORRESPONDENCE AND DISCUSSION

Although we cordially invite criticisms and expressions of opinion in these columns, THE METAL INDUSTRY assumes no responsibility for statements made therein.

THE ALUMINUM INDUSTRY

To the Editor of THE METAL INDUSTRY:

Each year, through the medium of THE METAL INDUSTRY, the aluminum trade is supplied with what purports to be a résumé of conditions existing in the aluminum industry, written by a "self-styled" "Aluminum Man." This so-called "Aluminum Man" is perhaps too bashful to supply us with his name, or is it that his connections are such that he does not wish it to appear in whose interest his annual article is written? However, it is obvious to those who read this annual aluminum article just who causes its publication.

Writing as "Aluminum Man," this correspondent of yours should be familiar with the status of the aluminum industry during the period he covers. Your Aluminum Man, however, makes one or two misstatements of fact to which we desire to call your attention.

The first is this: Your "Aluminum Man" states "that many firms contracted for more material than they could absorb," but he goes on to say that "this situation gave a false impression of the true status of supply and demand, the fact being with regard to aluminum that the supply of the country is undoubtedly more than equal to any normal demand." This is an entirely erroneous statement. The users of sheet aluminum, for instance, did not contract for more aluminum than they could ordinarily absorb, but contracted for only their normal requirements, and, contrary to what your "Aluminum Man" says, the chief source of supply in this country **was not able to meet that normal demand** for sheets of aluminum, and **never** has been able to meet that demand in the history of aluminum production in the United States.

It is quite true that during the second half of the year 1920 business in all lines became very much depressed, and the consumers of aluminum found that they were not receiving normal business, but that their business was way below normal, and they were receiving innumerable cancellations. This was particularly true in the cooking utensil industry and in the automobile industry. It was then that they could not absorb the metal for which they had earlier contracted, in accord with their usual normal requirements. Your correspondent goes on to say that "However, such a state of affairs stimulated the importation of a large amount of foreign aluminum." It is absolutely untrue that this state of affairs, created by the imaginative mind of the "Aluminum Man," stimulated the importation of foreign aluminum. What stimulated the importation of foreign aluminum was the chief source of supply's absolute inability to take care of a normal demand, as evidenced by the normal purchases during the first half of the year 1920 of aluminum. Consumers bought their normal requirements; the producer in this country was not able to take care of that normal requirement, and never has been able to take care of it. The only remedy and the only alternative for the consumer of aluminum, when he could not get the much-needed supply of aluminum from the chief source of supply in this country, was to import aluminum from abroad.

From personal observation, the writer knows that the chief source of supply in this country, during the first half of the year 1920, was supplying the independent cooking utensil manufacturers in this country with only 10 to 16 per cent. of the amount of aluminum for which they had contracted. Does this look like the supply in this country was more than able to take care of the demand? Does "Aluminum Man" actually believe that the consumers in this country contracted for over 600 per cent. more aluminum than they had any right to believe that they would use? The only time that the producer of aluminum in this country was able to supply the demand for sheets was when there **was not any demand at all**, and that was during the second half of the year 1920. Any independent cooking utensil concern in the country can testify to the fact that when his business was running normal, and when he had dire need of sheet to keep his operating force together to take care of his deliveries, he could get only a measly 10 to 16 per cent. of his requirements. He was actually forced to buy aluminum wherever he could find it, particularly from foreign sources.

The next statement of your "Aluminum Man" is as follows: "In spite of this abnormal condition, the contract price of the principal producer remained stationary throughout the year at 33 cents per pound." Your "Aluminum Man" evidently speaks of ingots, since this was reported to be the contract price of the chief producer for 98-99 per cent., or 99 per cent. aluminum ingots. However, during the second half of the year 1920, this same chief producer offered, quietly and confidentially, to various buyers of aluminum, those under contract and those not under contract, to deliver metal to them promptly and to make a confidential concession in price below the so-called contract price of 33 cents.

The next statement of your "Aluminum Man" is an absolute misstatement of fact, and entirely misleading. It reads: "In the 'open market' prices ranged much higher, at times 60 to 65 cents being obtained." This statement, directly following the statement as to the principal producer's price of 33 cents per pound on ingots, would lead one to believe that as high as 60 to 65 cents was obtained for ingots in the outside market. At no time during the year 1920 was a higher price obtained for aluminum ingots than the producer's price of 33 cents, and in practically every instance where sales were made of aluminum ingots other than those produced by the chief producer, the price was less than 33 cents.

The writer personally closed many hundreds of contracts for aluminum ingots in the so-called outside market during the year 1920, and not one of these contracts bore a price higher than 33 cents, and with the exception of one or two contracts for inconsequential quantities, the price was anywheres from 2 cents per pound and more lower than the chief producer's so-called contract price.

Perhaps your "Aluminum Man" means that in the "open market" aluminum sheet prices sometimes ranged much higher—at times 60 to 65 cents per pound. This would be more like the truth; but following his market quotation, of the chief producer, on ingots, one comes to the natural conclusion that he wants it believed that ingots were selling for 60 to 65 cents per pound. The fact that sheets were commanding a price during the first half of the year 1920, of 60 to 65 cents per pound in the outside market, is only evidence of the extreme demand for aluminum sheets, which the chief producer, as stated earlier in this letter, could not take care of. Surplus sheets were picked up by anxious stampers and cooking utensil manufacturers and automobile body builders to keep their plants going. They had to pay 60 to 65 cents per pound because they were at the mercy of those who had sheets, and the chief producer was not helping them out one bit. Ten to sixteen per cent. of their requirements was all they were getting from the chief producer, **who maintained his price,** but he **couldn't** deliver any aluminum sheet when it was urgently needed, and he **rushed in to deliver aluminum** ingots and sheets when there was absolutely no demand in this country, and cried, "We are able to take care of the entire demand of aluminum for the entire country!" Yes, "Aluminum Man" must know that this chief producer, about whom he talks, is able to take care of the entire demand of aluminum in this country **when there isn't any demand.**

The whole purpose of "Aluminum Man's" letter seems to be summed up in the last sentence, which reads: "The outlook for the year 1921 is rather uncertain at the present time. The important feature, however, is that there is an ample supply of aluminum in America to take care of any demands that may be made on it, and the producing companies are in a position to supply this demand, either in the form of ingot, semi-fabricated, or fabricated forms." The aluminum-consuming trade will indeed welcome this announcement, but let us hope that the same statement may be made in future years' résumé by "Aluminum Man," when the demand in this country for aluminum shall have been normal.

New York,
January 26, 1920.

BRILE & RATNER, INC.
L. M. BRILE, Pres.

Group Life Insurance

An Explanation of This Type of Insurance, Telling What It Is and What It Does

Written for The Metal Industry by FRANK S. McMANUS

Some time ago we were advised by a prominent brass manufacturing company of the death of one of their employees, and of the fact that his widow had received about $3,000 insurance and company benefit. This prompted us to investigate life insurance as taken out by a company for its employees, and this article is the result.—Ed.

Group life insurance is life insurance for employees, paid for by the employer, without medical examination or maximum age limit, or sex consideration.

The insurance ends when the employment ends, but with liberal provision to meet such conditions.

There cannot be fewer than fifty employees in the group and there must be a plan that avoids individual selection, but allows certain amounts for individuals based on,

1. Length of service,
2. Wage or salary.

For example, the following are typical cases of the three methods of writing the insurance. These are actual cases.

1. Length of service formula:

6 months	and	less	than	1	year	.....	$500
1 year	"	"	"	2	years	.....	600
2 years	"	"	"	3	"	.....	700
3 "	"	"	"	4	"	.....	800
4 "	"	"	"	5	"	.....	900
5 "	"	"	"	6	"	.....	1,000
6 "	"	"	"	7	"	.....	1,100
7 "	"	"	"	8	"	.....	1,200
8 "	"	"	"	9	"	.....	1,300
9 "	"	"	"	10	"	.....	1,400
10 "	"	"	"	11	"	.....	1,500
11 "	"	"	"	12	"	.....	1,600
12 "	"	"	"	13	"	.....	1,700
13 "	"	"	"	14	"	.....	1,800
14 "	"	"	"	15	"	.....	1,900
15 "	"	over				.....	max. 2,000

2. Wage or salary formula.

"Within the minimum and maximum limits of insurance covered by said policy the amount of insurance effective in the event of permanent and total disability or death, occurring in any year while this insurance is in force upon the life of the employee shall be one year's wage or salary. 'One year's wage or salary' shall mean fifty-two times the amount paid on the date of this certificate, or on the last preceding November 15, whichever is the later, to the employee as such weekly, where the payments are made weekly, or twelve times the amount paid to the employee as such monthly, where the payments are made monthly.

"The insurance limits under the aforesaid policy as to any employee are five hundred dollars ($500) minimum and five thousand dollars ($5,000) maximum."

These plans are retroactive, in that persons who have already put in the length of service qualified for the amounts according to that service. It must be said that the first plan is the best, as shown by experience and weight of opinion. The first plan offers an incentive to remain with the employer, and a reward, being retroactive, for those who have already served.

It permits of free discussion among the employees of the plan and the individual amounts of insurance and an expression of pride of service.

This insurance contract is made with the employer on a basis of yearly renewable contract, with a five-year guarantee of rates by the leading company. A certificate is given to each employee which shows—

1. Name of the insured employee.
2. Name of his beneficiary.
3. Initial amount of insurance.
4. "Permanent and total disability benefit," which guarantees to him the face value of the policy, either in cash or installments, as the employer may elect in each case, in the event of such misfortune overtaking the insured before reaching the age of 60. The chance of such misfortune at age 55 has been found to be much greater than usually supposed and arises from a variety of causes, such as insanity, bodily disease, loss of sight or of limbs, etc. It is a very important provision.

The certificate also contains the plan so that the employee may know what future advantages continued service will give him.

Many states require that the "conversion privilege" shall also be given, which, briefly stated, is the privilege of conversion by the employee within thirty-one days of ending employment to an individual policy for a similar amount at his then attained age, but at regular rates, without medical examination. This is a just privilege in view of the fact that many employees drop their weekly payment policies when the employer gives them free insurance.

Advantages of Group Insurance from the point of view of the employer, the employee, the employee's family and the whole community are too numerous to cover within the space of this article. Briefly, however, the employer takes a more efficacious way to engage the sympathy of the employee's family and the employee himself. A common interest is created between the employer and the family. This is an important alliance that has been neglected in the past. The psychology of doing for the family is that the average man takes greater pleasure in the thing that is done for them than if done for himself personally. The settlement of a claim is of great importance and is freely advertised by all concerns.

2. The advantage to the employee is very great, in that 15 or 20 per cent of them could not buy insurance at all, with a medical examination. Improved mental attitude results; hence, greater loyalty and co-operation and increased average length of service from year to year. The knowledge that his family has been cared for sufficiently to eliminate charity in the event of his death, has great weight.

3. The employee's family obviously is the gainer. In the majority of cases the wife pays for insurance. She, therefore, doubly benefits by this gift in that she has no payments to make during the lifetime of her husband and is protected at his death.

4. The community is distinctly benefited when it is considered that some millions of persons are covered under Group Policies. In the smaller cities it has a marked economic effect. The future development will tend to eliminate cases of distress, illustrated by such lists as the "100 neediest cases." The experience of the company is that four out of five payments meet conditions of immediate need and such payments are frequently made within a few hours, where such promptness is demanded.

Obviously, Group Insurance is one solution to the problem of how to keep employees on the job and assure the efficiency of experience and habit. Its cost is so small as to be a trifling factor in the consideration of the subject by employers. Roughly stated, a satisfactory plan may be installed for one or two cents per day per employee, depending upon the amounts.

One metal trade concern, with branches all over the country, had death payments during the epidemic amounting to $78,800 on 92 employees who died in 1918. These persons died in twelve or fifteen different states.

To obtain an exact premium estimate, the following information is required:

1. The plan. For example, $500 to $1,000 or a greater maximum, with increases of so much per annum to a certain maximum.
2. The date of birth of each employee.
3. The date of entering the service of the employer.
4. Preliminary inspection report of plant conditions.

A minimum amount is $500, at the end of the first year's employment, and the maximum never greater than $5,000. Coverage is issued immediately and automatically by the company which has the greatest volume of insurance in this line. This company also gives, without extra charge, a service plan for impressing the value of the insurance on the employees, such as a great variety of suggestions how best to keep the matter in the minds of the employees.

GROUP ACCIDENT AND SICKNESS INSURANCE

Group Accident and Sickness Insurance is another form of insurance of great value, both to the employer and employee, the family and the community. It is written upon groups of fifty or

more and provision is made for the employee to divide the cost with the employer, if the employer prefers it so. In the latter case it is written for fixed amounts of indemnity in units of $5, but not exceeding $40 weekly in any case. If the employer pays all, it can be written on a payroll basis, with an indemnity of percentage of wage, such as 50 per cent, or not exceeding 80 per cent. When written in this way the premium is charged on the percentage of the total annual payroll.

A variety of plans is offered. Coverage may be given from the first day for a limit of 26 weeks, or 52 weeks if desired. Coverage may exclude the first three days. It may exclude the first week. A very popular plan is with the first week not covered and a limit of 26 weeks on any one case.

A number of other plans have been well standardized, and, in addition, a plan will be worked out with the employer to meet his special requirements, if desired.

In closing, it may be pointed out that the concerns which have taken out Group Insurance have increased their coverage from year to year, cancellations have been almost negligible and usually in cases where the concern has retired from business or for some other reason have not had enough employees to continue. The leading company maintains special representatives for the purpose of conferring with prospects and business is accepted from brokers and agents generally. The regular insurance broker is in a position to secure the services of these special representatives upon request for his account.

The following are some of the notable concerns which carry Group Insurance and attached hereto is shown a specimen certificate:

Bridgeport Brass Company, Bridgeport, Conn.; brass tubes.

The Bunting Brass & Bronze Co., Toledo, Ohio; bushings and bearings.

The Chase Companies, Inc., Waterbury, Conn.; brass manufacturers.

Crane Co., Chicago, Ill.; valves.

Doehler Die Casting Co., Brooklyn, N. Y.; finished metal castings.

The Kennedy Valve Mfg. Co., Elmira, N. Y.; valves.

Pangborn Corporation, Hagerstown, Md.; sand-blasting machines.

J. W. Paxson & Co., Philadelphia, Pa.; foundry supplies.

Rome Brass & Copper Co., Rome, N. Y.; sheet metal and tubing.

Rome Mfg. Co., Rome, N. Y.; copper and brass goods.

Standard Brass & Copper Tube Co., New London, Conn.; seamless tubing and pipe.

A. B. Swoyer Co., Philadelphia, Pa.; brass tubes, etc.

Westinghouse Electric & Mfg. Co., East Pittsburgh.

General Electric.

Jenkins Brothers, New York and Bridgeport.

THE PLATING INDUSTRY

AN ADDRESS BY CHARLES H. PROCTOR, PLATING-CHEMICAL EDITOR,

BEFORE THE ROCHESTER CHAMBER OF COMMERCE, URGING STANDARDIZED METHODS.

Mr. Proctor traced the development of electroplating from Zozimus, the Greek alchemist, who first saw that copper could be reduced from its solution by iron, to the present day. He spoke of developed "fire-gilding," and the French Ormulu finish; the researches and discoveries of Volta, Faraday, Daniell, and Brugnatelli; the work of Jordan, Spencer and Jacobs, and finally, Sir Humphry Davy's discovery of the metals sodium and potassium, which were the basic factors of modern cyanides.

The history of cyanides commenced when in 1704, Diebach, a German manufacturer, obtained from a product called Dippels Oil, distilled from dried blood, bones and other animal matter or waste, a blue solution, which received the name of "Prussian Blue," and for a long time the cyanide industry was limited to the preparation of this substance of unknown composition, used as a dye and a pigment.

The crystalline product obtained by treating "Prussian Blue" with caustic potash was then known as blood-lye salts. The nature of these bodies was first discovered by Lussac in 1814. He found that they were two compounds of a nitride of carbon (C_2N_2) to which he gave the name "cyanogen" (blue generator), and these became known as "cyanides." In the early days of the plating industry the old-time plater of silverware invariably made his own cyanide by heating yellow prussiate of potash and carbonate of potash to fusion in an iron pot. The results were a dark gray product of uncommon cyanogen content. Platers of today can obtain an American cyanide, such as sodium cyanide, 96.98%, cyanogen 51.52%, or the equivalent of 120 to 130 lbs. of 94.96% potassium cyanide based upon a cyanogen content of 34.36%.

He spoke also of the work of the Elkingtons, Barratt, John Wrigler and William Milward in advancing silver plating in England; how the Rogers Brothers brought silver plating into the United States with their standard "Triple Plate" of 12 Dwt., and of many others prominently identified with the advance in the art.

Mr. Proctor made a strong plea for standardized methods and control of solutions to obtain a uniform plate. The methods recommended were as follows:

1. Decide on a known standard for the weight of metal to be deposited upon the surface area of your product.

2. Develop the most efficient type of plating solution that will give you the results you want in the shortest time possible at the minimum cost of time, labor and materials.

3. When plating solutions are so prepared from known proportions and prove to be efficient solutions, then maintain them as standard solutions by standardized methods of replenishing to maintain them in continuous working condition.

4. Determine the surface area of your product per tank load, the amount of metal to be deposited, according to your standard, the amperage supported by the voltage and the time required for such a deposit.

5. Maintain absolute electrical control of solutions as nearly as possible by volt and ampere meter, and if necessary the ampere hour meter; all solutions to be separately controlled.

6. After you have once prepared an efficient standard solution that you can designate as a standard, then each work day have an analysis made of the solution to determine its deterioration, how much metal has been dissolved from the anode, how much lost from the solution, the decomposition of the chemicals, how much solution is lost each day. When you know these things you can replace them. They must be replaced to make your plating operations continuous. It is easy to see that there is work to be done by the chemist as well as the plater.

7. There are only two types of solutions that will give a cathode and anode efficiency at near the 100% mark. They are the silver cyanide and copper sulphate solutions, but they must be carefully prepared and as carefully maintained. All other types of solutions are somewhat less efficient, but they can be prepared and maintained so that they will give good results.

Mr. Proctor, continuing, made a plea for better conditions in plating departments. He said that thousands of dollars were spent in perfecting mechanical operations, and if the same attention were paid to the plating and finishing departments, thousands of dollars could be saved in defective finished products. He referred to the splendid results obtained in many large plants where standardized methods had been installed, and the chaos that existed in other large plants where no standardized methods had been installed. Particularly in the automobile rim industry. There were few of these plants where auto rims were plated in thousands per day that had any control whatever over the metal deposited. It was a rule of thumb, cut and try method from A to Z.

He concluded by offering as a motto to American manufacturers, "Better Goods Better Finished, and a Hall-Mark Guaranteed Product."

SHOP PROBLEMS

IN THIS DEPARTMENT WE ANSWER QUESTIONS RELATING TO SHOP PRACTICE

ASSOCIATE EDITORS { JESSE L. JONES, Metallurgical; WILLIAM J. REARDON, Foundry; PETER W. BLAIR, Mechanical; LOUIS J. KROM, Rolling Mill; CHARLES H. PROCTOR, Plating-Chemical; CORYDEN P. KARR, Exchange-Research }

ACID DIP FOR SILVER BUCKLES

Q.—I am handling some sterling silver belt buckles and when I am firing them in nitric acid solution some come out black and some white. How can I fix this? The solution is made up of 3 quarts of nitric acid and 1 quart of water.

A.—We presume the sterling silver buckles are annealed or fired before immersing in the acid dip to remove the fire scale. If so it seems to us that the temperature used in annealing is not uniform. An excessive temperature would produce copper oxide upon the surface of the silver, due to the copper used as the alloy. The oxide would only be partly reduced in the nitric acid pickle.

Try the following combination to replace it:

Water	1 gallon
Sulphuric	1 pint
Bichromate of soda	2 ozs.
Temperature 180 deg. Fahr.	

Fireless sterling silver can be produced if the silver is annealed in a cyanide mixture heated to 1,200 deg. Fahr.

The mixture should be prepared as follows:

Sodium cyanide 96.98%	5 ozs.
Soda ash 58%	8 ozs.
Common salt	3 ozs.

Heat in a cast iron or steel pot; after annealing quench in cold water.—C. H. P. Problem 2,909.

ALUMINUM MIXTURES

Q.—I am making 6 in. aluminum pulleys and having them cast in a foundry. They run 2 to the pound and cost me $1 a pound. Please advise if there is any other metal I can use, as light as aluminum, that will not rust, and will cost about 50 to 60 cents a pound.

A.—There are cheaper alloys of aluminum, but they all add to the weight more or less. Aluminum 67, zinc 33 is cheaper and also strong. It has a specific gravity of 3.30. It is rather hard to cast in heavy work.

Alloy No. 12, the one in general use, is composed of aluminum 92, copper 8, and has a specific gravity of 2.80. It is considered one of the best casting alloys.

Unfortunately at the present time there is no alloy used in the foundry that is as light as aluminum that will meet the desired cost. Magnesium is now being used in casting and may be much cheaper than the present price of aluminum in a short time. It cannot come too quick for a lot of people.

However, I would suggest that you have your patterns mounted on molding machine plates and go to a foundry that uses molding machines and get the production. That is the only way you can beat the high cost of aluminum, and I am quite sure that you will be able to get your castings for 60 cents per pound.—W. J. R. Problem 2,910.

ANTIQUE COPPER

Q.—We are desirous of obtaining the latest method for obtaining antique copper finish on plated steel parts, other than by taking the plated parts and scrubbing them by hand with a small scrub brush and an abrasive material. We surely think there is a more speedy method of obtaining this finish, and would be pleased to have suggestions on this subject.

A.—It seems to us that an unnecessary amount of manual labor is used in producing the finish. Many firms brush their product down with bristle brush wheels, that are run at about 800 revolutions per minute, sewed buffs or felt wheels are used for oxidized copper, with which is used a "White Diamond" polishing medium, as the cutting factor to cut through the oxidizing and show the copper plate in relief When bristle brushes are used the medium is usually a mixture of equal parts of silica sand and pumice stone with water. Possibly a tumbling method could be used, with sand, pumice stone and maple sawdust being used as the abrasive. —C. H. P. Problem 2,911.

ANTIMONY ANALYSIS

Q.—What are the analyses of Japanese and Cookson's antimony?

A.—The analysis of Japanese and Cookson's antimony was given by W. A. Cowan in a paper presented at the Institute of Metals, September 7 to 11, 1914, as follows:

	Japanese		Cookson's	
Lead	.443	.424	.041	.102
Tin	.175	.012	.035	trace
Arsenic	.008	.095	trace	.092
Bismuth	....	none	....	none
Copper	.034	.043	.040	.046
Cadmium	....	none	....	none
Iron	.015	.007	.010	.004
Zinc	trace	.023	trace	.034
Ni and Co	....	none	....	.028
Sulphur	....	.201	....	.086
Antimony	....	99.195	....	99.608
Total		100		100

—A.B. Problem 2,912.

BLACK ON DIE CASTING

Q.—How can I color zinc die castings black?

A.—Die castings can be colored black in the following solution:

Water	1 gallon, temp. 200° Fahr.
Sodium cyanide	6 to 8 ozs.
Sodium arsenite	4 to 8 ozs.

To prepare the sodium arsenite dissolve white arsenic in caustic soda, using equal parts of the materials. For one pound of each use ½ gallon of water at 100° Fahr. (the caustic soda will increase the temperature to near the boiling point) then add the arsenic. Prepare the cyanide solution first, then add enough of the sodium arsenite solution to give the desired color. It may be necessary to prepare a slightly stronger solution than the formula given.

While coloring the die castings, keep them moving in the solution. Also maintain the temperature given.—C. H. P. Problem 2,913.

BLACK ON STEEL

Q.—How can we color steel articles black?

A.—A process of coloring iron or steel articles black was patented June 8th, 1920. U. S. patent No. 11,342,910.

This method consists of preparing a solution upon the following basis:

Water	1 gallon
Caustic Soda 74.76%	14 ozs.
Sodium Nitrate	6 ozs.

The solution is used at a temperature of 180 to 200 deg. Fahr. The articles to be blackened become alternately anode and cathode. Sheet carbon is used as the cathode. The cycle is repeated three times at five minute intervals. The articles to be colored become the anode, then the cathode and then the anode again.

After coloring the articles, wash them in cold and boiling water and then lightly coat them with a thin film of a suitable oil.

Another method that is used extensively for producing a

blue black bronze is to immerse the articles after cleaning and drying in a molten mixture consisting of 16 parts, by weight, of sodium nitrate and 1 part dioxide of manganese, at 600 deg. Fahr., for a moment or two until colored. Then immerse in hot water at a temperature of 200 deg. Fahr., upon which is sustained a thin coating of a suitable oil, such as linseed or similar oil.—C. H. P. Problem 2,914.

BLUING GREY IRON

Q.—I would greatly appreciate any information you could give me in bluing grey iron range tops after they have been polished. Are they blued in regulation manner, that is, nitrate?

Would like to give them a uniform color and perhaps prevent rusting to some extent.

A.—A light blue can be obtained on iron or steel by heating to 600 or 700 deg. Fahr. or by imbedding in sea sand heated to this temperature or by heating to the same temperature in a molten mixture of equal parts of sodium nitrate and sodium nitrite, quenching in water, drying and afterwards slightly oiling.

For Blue black the heat is increased up to 1,000 deg. Fahr., sodium nitrate only is used, with an addition of ½ oz. of black oxide of manganese per pound of sodium nitrated. When the color is produced quench and oil.

The black magnetic oxide of iron, well known under the name of the Bower-Barff finish, which is a rust proof finish when finally oiled with hot linseed oil is produced by heating the parts to a cherry-red, 1250 deg. Fahr., and then blowing super-heated steam on them. Benzine or gasoline is sometimes introduced into the steam when blowing. The latter method is used by one of the best-known manufacturers of builders' hardware in the United States.—C. H. P. Problem 2,915.

BUFFING NICKEL SILVER

Q.—What sort of a wheel should I use for buffing German or nickel silver? Is there any coated wheel that will take the place of pumice?

A.—German silver is not a soft metal. The reason that trent sand is used in sand buffing operations is so that the hollow of tea or table spoons may be polished without rounding or cutting away the edges of the spoons, as would happen if the polishing materials were applied to the buff wheels as in regular buffing on flat or other surfaces with tripoli composition.

The only coated wheel you could use would be one coated with flour emery by the aid of glue. The wheel to give some flexibility, should be made up of canvas or heavy unbleached muslin sewed together. The wheel so prepared, coated with polishers' glue and then rolled in flour emery, when dry and hard, should be fined down with a flint stone and apply a mixture of equal parts of mutton tallow and beeswax melted together. The mixture will prevent scratches in polishing.

It is possible that a tampico or bristle wheel could be used and a polishing medium made up of trent sand, mutton tallow and beeswax, mixed in equal proportions by weight and melted to a fluid mixture and then poured into moulds to get the proper shape for handling with the wheels. The sand can be replaced with flour emery if so desired.—C. H. P. Problem 2,916.

CLEANING TIN

Q.—How can I keep tin from oxidizing when it is in a molten condition?

A.—Tin is a very difficult metal to keep clean. It oxidizes easily and rapidly, and if it is necessary to keep it in molten condition, it should be held at as low a temperature as possible, say about 500 degrees Fahr. A cover should also be used to keep the tin bath from oxidizing. This had better be powdered charcoal than anything else. Sal-ammoniac can be used, but more for reducing tin which has already been oxidized than for protecting clean tin from oxidation.

If the tin is absolutely clean and you have simply the top covering of dross to contend with, this can be easily removed by means of a flat, perforated skimmer on the end of an iron bar. The skimmer is about 12 to 16 inches in diameter, and the bar about half an inch thick This can be obtained from any foundry supply house. If, however, the tin is contaminated, it will be necessary to clean it. The cleaning is effected by puddling or tossing with sal-ammoniac or with sulphur and rosin. In just the same way that the antimonial lead or type metal mixture is cleaned.

You will find it best under most conditions to follow up the sulphur treatment with rosin because, although the sulphur is an exceilent deoxidizer, an excess is almost always used which causes a combination between the sulphur and the metal. This sulphur is removed by the use of rosin.—A. B. Problem 2,917.

DAIRY FIXTURE METAL

Q.—Please send us a mixture for dairy fixture metal.

A.—Dairy metal fittings are usually made in die castings or permanent molds. A high tin mixture is used on first-class work. This tin mixture is similar to britannia and is composed of:

82	tin	90	tin	85	tin
16	antimony	8½	antimony	10	antimony
2	copper	1½	copper	3	zinc
				2	copper

An aluminum alloy is used for cream separators, pure aluminum is used for stamp work, and as near pure as possible for cast work. One mixture that gives good results is composed of 96 aluminum, 2 copper, 2 magnesium. The white metal alloy has a white, almost silver white, color, and is capable of taking a high polish. Another advantage gained is that in die casting little or no machine work is necessary, as all castings can be cast to size and with a perfect finish. Other metals can be used, such as brass, but tinning of this material is necessary.—W. J. R. Problem 2,918.

FINISHING CAMERA TRIMMINGS

Q.—I will be very thankful to you if you will advise me through your "Shop Problem" answers some information regarding the following:

I am using a camera which is fitted with brass trimmings that have become tarnished by constant use. It is now my desire to color these parts without removing them from their position, as I fear that to remove them might possibly throw some of the interior mechanism out of alignment.

The original color of these parts was a bark gray. This, I am advised by the maker, was produced by plating over silver plated brass, and cannot be restored or replaced without removing the parts.

Can you therefore advise me what kind of a preparation I may use to either duplicate this color or to change it to a dark blue or even a black? Any formula which you may advise must be of such a nature that it can be applied with brush or sponge.

A.—It would be extremely difficult to try to apply any metal coating or oxide to your camera brass trimmings without removing them. The best results you can possibly obtain and in keeping with the parts would be to apply two thin coats of a hard rubber finish lacquer. The lacquer will give a black finish equaling hard rubber. It will dry hard. A day should elapse between the first and second coat.

Apply the lacquer with a camel's hair or badger hair brush, flowing on the lacquer instead of brushing as in painting. If you write to any lacquer firm advertising in THE METAL INDUSTRY, you can obtain the lacquer.—C. H. P. Problem 2,919.

GOLD RECOVERY

Q.—How can I recover the gold from goldsmith's crucible sweeps?

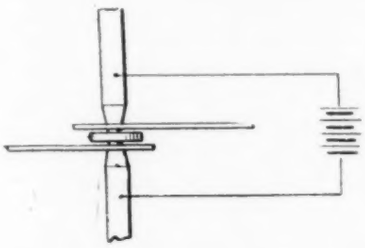
A.—Goldsmith's sweeps can be smelted in the following manner:

Burn the sweepings with the addition of some saltpetre in a red hot crucible. Lixiviate the residue with water, dry and melt with the addition of two per cent of dehydrated borax. Dissolve the mass thus obtained in aqua regia. Evaporate this solution until it commences to become viscous. Dilute with water and immerse a bright sheet of copper in the solution. This will precipitate the gold in the form of brown powder, which is filtered off, washed, dried and melted with a small quantity of borax. The product will be pure gold. —A. B. Problem 2,920.

PATENTS

A REVIEW OF CURRENT PATENTS OF INTEREST

1,355,224. October 12, 1920. **Chemical Welding.** James H. Gravell, Brooklyn, N. Y., assignor to Thomson Spot Welder Company, Boston, Mass., a corporation of Massachuseees.



Generally stated the invention consists in providing a chemical substance which when ignited generates a high temperature very rapidly so that the surface or surfaces of metal in contact with the substance is immediately raised to a welding temperature at which time localized pressure is applied to the heated section to complete the weld. When this substance is placed between sheets of metal and ignited the opposing surfaces in contact with the substance are instantly brought to a welding temperature and when forced together extrude the welding substance or material and contact with each other and, being at a high temperature, weld together. If desired, especially in the case of thin metal, the substance may be placed on the outer surface.

1,355,769. October 12, 1920. **Method of Making Alloys.** Arthur George Mumford, Colchester, England.

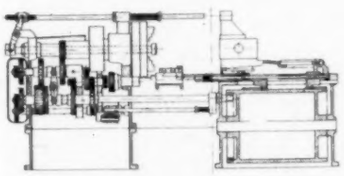
This invention relates to an improved method of making alloys of copper containing fractional percentages of tin and zinc and it has for its object generally to make reliable castings for floats for automatic feed water regulators and the like which are subjected to very high temperatures and pressures and a constant variation of same and which will not become water logged and specifically to so mix the small percentage of zinc, which is a highly volatile metal, with the other metals that the percentage of same can be insured with a reasonable degree of accuracy.

A suitable alloy for the purpose comprises 86.168 per cent of copper, 11.97 per cent of tin and 1.842 per cent of zinc.

In making this alloy a white metal alloy composed of 61 per cent of tin, 29.7 per cent of copper and 9.3 per cent of zinc is first made and run into an ingot, and then the final alloy is made of 80.36 per cent of copper and 19.64 per cent of the aforesaid white metal alloy.

1,356,020. October 19, 1920. **Metal-Working Machine.** Ernest B. Sellew, Pawtucket, R. I.

One feature of the present invention consists in providing means whereby in a machine, in which the feeding movements of the turret-slide are derived from the spindle operating mechanism, two different speeds may be given to the spindle in one direction and the spindle be rotated in the reverse direction, the change of speed of the spindle and the reversal of the spindle being automatically affected and the spindle being at all times operated, and consequently the feeding movements of the turret-slide derived, from a single constant speed driving member.



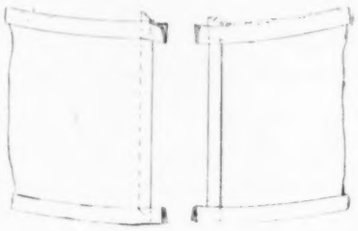
1,355,830. October 19, 1920. **Plastic Metallic Packing.** Byron W. Goodsell, Chicago, Ill.

This invention is concerned with plastic metallic packings which, owing to their plastic nature, are capable of being placed by hand in a stuffing box of any shape or size and perfectly fitted therein, and which will not heat, scratch or otherwise injure a rod or other member working therein, and which does not harden after years of service and may be molded and replaced and thereafter operate as a practical and frictionless packing.

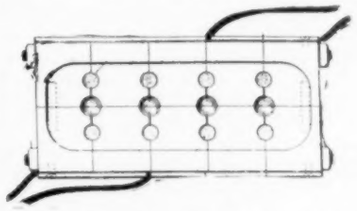
The compound in which this invention finds its embodiment essentially consists of granulated babbitt metal, brown mica flour, beeswax and cylinder oil and a binder of metallic wool, the babbitt metal and metallic wool forming about 92 per cent of the compound.

1,356,422. October 19, 1920. **Foundry-Barrel.** William G. Avery, Painesville, Ohio.

The objects of the invention are to provide an improved form of metallic container or cask, especially such as are employed in industrial plants for receiving materials or storing or shipping abroad or transporting the materials within the boundaries of the establishment. The containers are adapted to contain metallic articles such as bolts, rivets, metal stampings or other articles either hot or cold, and hence they must be capable of enduring heat and rough handling without injury or distortion in shape.



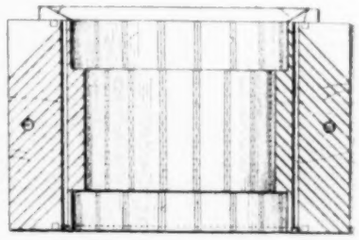
1,356,713. October 26, 1920. **Casting Method.** Frederick Hachmann, St. Louis, Mo., assignor, by direct and mesne assignments, of one-fourth to John A. Dowdall, and one-fourth to Bernard Greensfelder, both of St. Louis, Mo., and one-half to National Metal Die Mold Company, St. Louis, Mo., a corporation of Missouri.



This invention relates to a casting method and apparatus, and more particularly to a method and apparatus for casting metals, such as brass, bronze and other copper alloys.

Some of the objects of this invention are to provide a casting method and apparatus in which the withdrawal of the air and other gases from the mold cavity is insured, and in which the walls of the mold cavity are treated in such a manner as to prevent adhesion of the material, to cast, to the mold.

1,356,712. October 26, 1920. **Casting Mold.** Frederick Hachmann, St. Louis, Mo., assignor by direct and mesne assignments, of one-fourth to John A. Dowdall and one-fourth to Bernard Greensfelder, both of St. Louis, Mo., and one-half to National Metal Die Mold Company, St. Louis, Mo., a corporation of Missouri.



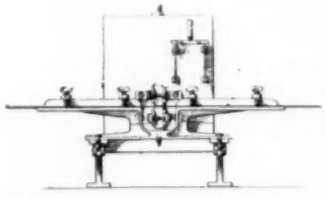
In application Serial No. 159,236, filed April 2, 1917, executed of even date herewith, there is described a casting mold, provided with venting passages to insure withdrawal of the gases from the mold cavity, and provided with lubricant conducting passages adapted to supply to and maintain on the walls of the mold cavity, a lubricant, so as to prevent adhesion of the metal to the mold. In the particular embodiment described in said application, these passages are formed

in the body of the mold; it is, therefore, necessary to subdivide the mold into a series of blocks in order that the small passages may be cut into the faces of the blocks. Such a construction is, however, expensive, difficult to make, and difficult to keep in repair.

Some of the objects of this invention, therefore, are to develop a casting mold of the above type, in which the venting and lubricating passages are formed in such a manner as to cheapen the construction of the mold, and so as to permit accurate and reliable operation.

1,357,080. October 26, 1920. **Brazing Machine.** Robert Jeremiah Peck, Key West, Florida.

This invention relates to a brazing machine, and aims more particularly to provide a device of this nature intended to braze the ends of a strip of metal such as a band saw, together.



With this in view, a brazing machine has been constructed which will be capable of joining together the ends of metal strips, and which is particularly applicable to the connection of the ends of a band saw and by means of which an efficient and strong joint will be formed.

1,356,715. October 26, 1920. **Casting Mold.** Frederick Hachman, St. Louis, Mo., assignor by mesne assignments to National Metal Die Mold Company, St. Louis, Mo., a corporation of Missouri.

An object of the invention is to provide a casting mold having a mold cavity adapted to form a casting and having one or more pockets or chambers adapted to contain a substance which, when subjected to heat of the mold, will be converted into a volatile carbonaceous matter, and passages for conducting the carbonaceous matter into the mold cavity, where it will adhere to the wall of the cavity and prevent adhesion of the casting.

Another object is to provide an improved casting mold having novel and efficient means for producing and conducting to the wall of the mold cavity a volatile carbonaceous matter that will prevent adhesion of the casting.

1,375,550. November 2, 1920. **Chemical Ware or Technical Apparatus and Alloys for Making Same.** Frank A. Fahrenwald, Cleveland, Ohio.

This invention relates to apparatus for use in the manufacturing chemical industry and has for its object the provision of an inexpensive, chemically resistant alloy for the construction of tanks, valves, pipes, fittings, evaporation pans, stirrers, and the like which shall be sufficiently strong to resist accidental breakage, and also soft enough to permit being machined to shape. All such devices are included under the term "chemical apparatus."

1,358,147. November 9, 1920. **Zinc Alloy.** Hans Goldschmidt and Karl Müller, Essen, Germany, assignors by mesne assignments to the Chemical Foundation, Inc., a corporation of Delaware.

The object of this invention is an alloy of zinc and aluminum containing manganese.

By alloying zinc (for which purpose commercial spelter containing lead may be used) with an amount of aluminum not considerably higher than is necessary for forming the eutectic mixture zinc-aluminum, that is to say, 5.3 per cent of aluminum, alloys are obtained which can be forged and rolled within certain limits of temperature. However, such binary alloys of zinc and aluminum show the heavy drawback that they do not yield sound castings.

1,357,297. November 12, 1920. **Solder.** Bird E. Newell, Watson, Minnesota.

This invention provides an improved solder for soldering together various different kinds of metal.

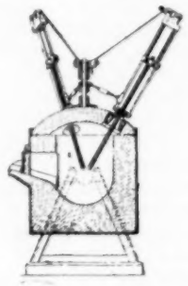
The solder is made of the following ingredients:

Ammonia muriate, borax (powdered), mercury, block tin, and lead.

These metals have, in practice, been alloyed together in approximately the following proportions, to wit:

Ammonia muriate (granular)	½	oz.
Borax, powdered	1	oz.
Mercury	2½	oz.
Block tin	10	oz.
Lead	13	oz.

1,359,067. November 16, 1920. **Arrangement of Electric Furnace Electrodes.** Thorleif Mandt Hvidsten and Arne Hildor Ingelsrud, Christiana, Norway, assignors to Det Norske Aktieselskab for Elektrokemisk Industrie, Christiana.



In order to obtain the best results with open electric arcs they must be arranged so as to concentrate their radiation on the molten bath without heating too strongly the walls, roof or other parts of the furnace.

According to the present invention great advantages are obtained as compared to the hitherto known electrode arrangements. The furnace can be started in a very simple manner without the use of a foreign source of heat, and the open electric arc is strongly convexed toward the bath of the furnace, thus concentrating its heat of radiation on the bath, while the walls and roof of the furnace are well protected. Further the electrodes may be regulated in a simple manner during operation of the furnace.

1,359,194. November 16, 1920. **Antifriction Alloy and Method of Manufacture.** Layton M. Parkhurst, Chicago, Ill., assignor by mesne assignments to H. Kramer & Co., Chicago, Ill., a corporation of Illinois.

It has been found that the hardness of a lead-antimony alloy may be increased by replacing a part of the antimony by tin and copper. It was also discovered that greatly improved results are obtained by alloying the tin and copper at a temperature below that at which copper melts. A further discovery which was made is that small additions of certain substances, notably phosphorus, increases the hardness very materially.

1,359,137. November 16, 1920. **Cement for Filling Voids in Brass Castings.** Raymond Samuel Wile, New York, N. Y.

This invention relates to a process of removing defects in brass castings or rolls by filling the holes or voids therein with a brass cement for the purpose of perfecting such castings or rolls and making the same substantially as good as a casting or roll is when perfectly cast and new and useful composition of matter used therefor.

This process consists in the formation of a cement composed of brass grindings or disintegrated brass mixed with not more than ten per cent of its weight of lime, preferably finely ground burnt lime, and by adding thereto sufficient phosphoric acid to moisten the mixture just prior to the application thereof to the casting or roll.

1,359,010. November 16, 1920. **Soldering Flux.** Edgar L. Williams, Lynn, Mass.

The object of the present invention is to provide a flux which will obviate the above objections, which will leave no residue, and which will produce a clean and strong soldered joint without the necessity for subsequent dressing or washing off; and which will solder any joint by means of a soldering iron or gas torch without involving corrosion of the metal at the joint. It has been found by experiment that a flux composed of substantially 100 parts of alcohol (denatured), 100 parts of rosin (preferably in the powdered form), and 25 parts of aromatic spirits of ammonia is an excellent flux and is especially applicable for fine work as for soldering of electrical instrument springs.

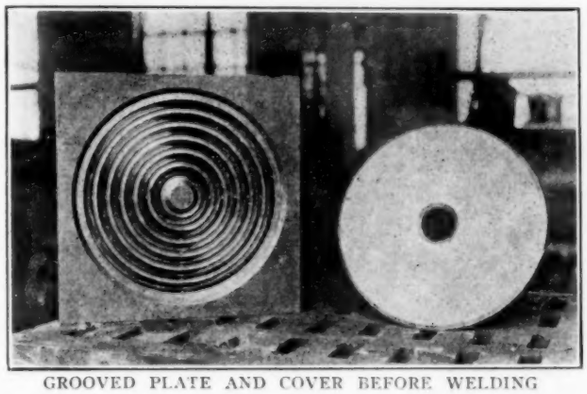
EQUIPMENT

NEW AND USEFUL DEVICES, MACHINERY AND SUPPLIES OF INTEREST

UNUSUAL WELDING APPLICATION

The first and last stages of an interesting and unusual application of welding are illustrated herewith.

This work was performed by the welding shop department of the Oxweld Acetylene Company at its Newark (N. J.) plant, for the Watson-Stillman Company, manufacturers of hydraulic machinery, Aldena, N. J. The latter company has a contract to furnish steam-heated brass platens for the curing of phonograph records.



GROOVED PLATE AND COVER BEFORE WELDING

After trying a number of methods of making the necessary steam passages in castings by the use of cores, it became evident that satisfactory castings could not be produced by this method. Accordingly, a new line of procedure was undertaken, to wit: In a solid rolled-brass plate (1½" thick by 14" square) concentric grooves were turned to a depth sufficient to give the necessary steam capacity. The whole working face of the plate (12" diameter) was also cut away to a depth of ⅜", except for a central boss, to accommodate a cover plate which was to be welded to the

TWO PLATES WELDED

central boss and to the outer circumference of the undercut. This central boss and the outer circumference of the undercut were chamfered away in the manner usual for preparing an edge to edge weld. The circular cover was then prepared with the edges bevelled in the same manner, leaving the usual trough for welding. A specially prepared clamping jig was then affixed to prevent warping, due to contraction strains, the entire job was preheated, the welding done in the usual way and the plates allowed to slowly cool in the fire. As a result of the annealing all contraction strains were satisfactorily eliminated.

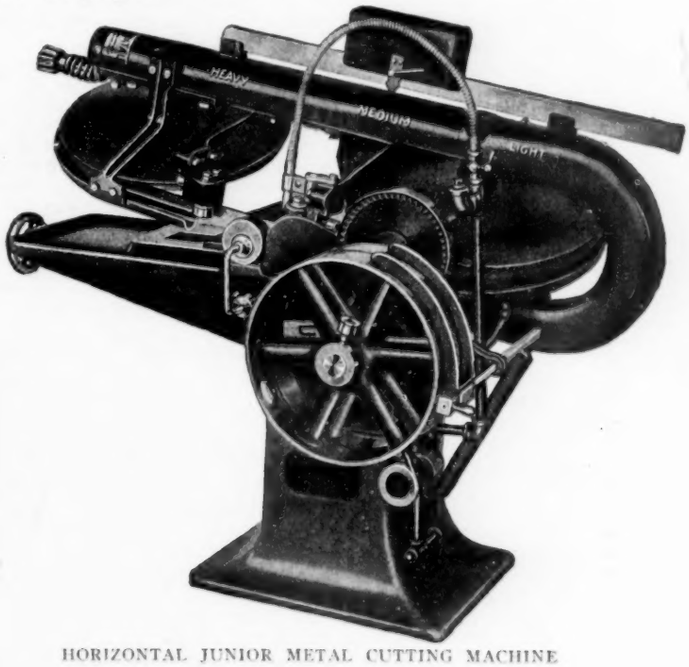
The final operation was performed by facing off the plate in a lathe, and the work was so well done that it was barely possible to discover the joints. The plates have given complete satisfaction in service.

NEW METAL CUTTING MACHINE

The Horizontal Junior Metal Cutting Machine, manufactured by the Metal and Saw Machine Company, Inc., Springfield, Mass., is a general purpose quantity production tool for cutting metals up to 4" x 4". It is useful for all branches of metal working industry where metal is to be cut to length.

The construction is of the horizontal type, using band saw, i. e., band saw holding member permanently held in plane parallel with bed on which work is placed. The cutting is done with the endless band saw, which is fed into the work; the band is 8' 4" long x ¾" x .032.

The sawing section is held rigid and square to the work by specially designed adjustable roller guides, assuring straight cut and freedom from vibration. The machine is equipped with belt-driven gear type, pump furnishing adequate supply of cutting fluid when wet cutting is desired. It is stated that cuts can be made to 1/64" or straighter. Proper band tension is made possible by hand adjustment on supporting head. There is an adjustable gravity feed, and a graduated scale on supporting head for this purpose.



HORIZONTAL JUNIOR METAL CUTTING MACHINE

Advantages claimed over power hack-saw are as follows :

.049" kerf as against .079—16 ga. .063—18 ga.

Continuously cutting band using every tooth, as against only ¾ of teeth in hack-saw blade.

Band under proper treatment and selected properly, with metal to be cut taken into consideration, should give average 20 hrs. cutting, and in many instances will run as high as 60 hrs.

Will cut straighter because band is properly lined up by adjustable guides.

Band actuating mechanism so designed that necessary driving power is furnished in continuous flow. (No lost motion and no power applied except for actual cutting.)

Entire construction along lines of approved machine tool design.

Not a power driven adaptation of an old-fashioned method, but a tool designed especially to meet the present-day demands for accurate, fast metal cutting at a low production cost.

Over cutting-off saw:

.049" kerf as against .250".

Original cost at least 50%, probably 75%, lower.

Can be operated by unskilled labor.

Uses inexpensive band instead of expensive circular saw.

NEW TESTING MACHINE

Considerable work has been done during recent years on the application of the "single blow" or "impact" notched bar test of metal as it is universally recognized that the notched bar test shows differences in the quality of heat treated steel and other metals which are not brought out by either tensile, hardness, or microscopic investigations.

A number of notched bar testing machines have been designed and have come into use (Charpy, Fremont, Izod, Amsler) which differ largely in the method of applying the impact blow, of supporting the specimen, size of specimen, shape and size of notch, etc. The great difficulties encountered in the use of these machines and the impossibility of converting the results from one type machine into those of another have been shown* and are well known to those engineers who are familiar with the operation of these machines and with the difficulties of correct interpretation of test results. For instance, the Charpy test is much less discriminating in cases of notched-bar "brittleness" on low impact value material, the energy required to break the test piece per sq. cm. being less by the Izod than by the Charpy method, while with high impact material the energy absorbed per sq. cm. is greater at times with the Izod than with the Charpy notch. If the sectional area of the Charpy test-piece were the same as that of the Izod test-piece, the former would give in cases such as those under discussion considerably higher values of energy absorbed.**

A great deal of the difficulty found in impact tests is due to the fact that in breaking notched bars in a single blow impact machine, a single figure only is obtained, representing the energy expended in breaking the test piece plus an unknown and variable amount of energy expended in vibrations, friction, etc., and no information is made available as to the values of the various factors of which this figure is the integral. If a corresponding figure of work done was all that could be obtained from a tensile test, it certainly would be equally valueless and the results obtained would be equally liable to misinterpretation.

In breaking a notched-bar test-piece there are two governing factors at each moment: the angle to which the specimen was bent and the resistance which it offered to the external bending moment which was producing the deflection. It has been shown that if a notched-bar specimen was broken slowly, by static pressure, the work expended is comparable with that measured by a dynamic impact machine, and this static method is much more effective in distinguishing between brittle and ductile metals. By means of such static tests it is possible to obtain exact information, at each stage of the test, of the value of the two factors mentioned above, without involving any appreciably more time or trouble than is taken in breaking a similar specimen in a single blow machine.

DESCRIPTION OF THE HUMFREY AUTOGRAPHIC STATIC NOTCHED-BAR TESTING MACHINE

Having in mind the serious limitations of the single blow machines, Mr. J. C. W. Humfrey designed and patented an Autographic Notched-Bar Testing Machine, illustrated diagramatically in Figs. 1 and 2. The test piece "A" is gripped in the vise "B" so that the jaws of the vise are in line with the notch in the test piece. The socket "C" is attached on the projecting end of the test piece, and is a reasonably close fit thereon. A bending stress is applied to the test piece by means of the winch "D" and the wire "E" which is attached to the outer end of the spring bar "F." The inner end of the spring bar is firmly fixed to the socket "C." The outer end of the spring bar is supported by two rollers "G" and "G1." The socket "C" carries also a rigid bar "H."

The deflection of the spring bar "F" is a measure of the bending moment applied to the test piece. Since the rigid bar "H" is not subjected to any bending moment it will move through the same angle as the socket "C" and this movement will therefore be a measure of the bending of the test piece. The pen "J" slides upon the rigid bar "H," its position being determined by the thin wires or cords "K" and "L," which are kept taut by a light spring

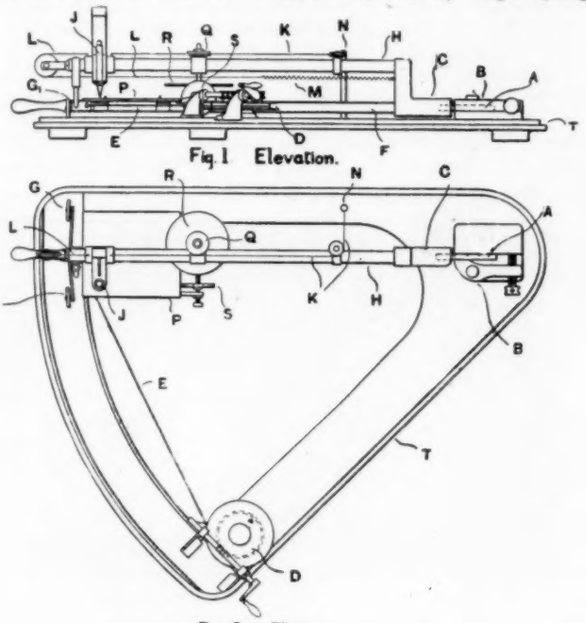


Fig. 1 Elevation.

Fig. 2. Plan.

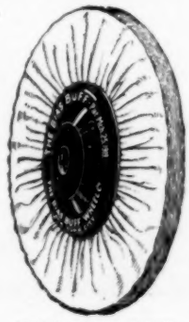
HUMFREY TESTING MACHINE

"M." One end of the wire "K" is attached to a post "N" so that as the rigid bar "H" moves in consequence of the bending of the test piece the wire "K" will draw the pen to the right. The point of the pen marks upon a calibrated chart "P" carried on the spring bar "F," therefore, if the test piece offers no resistance whatever to bending force the pen would draw a horizontal line on the chart, the length of which is proportional to the angle through which the test piece is bent. As, however, the test piece does offer resistance to bending there will be resulting motion between the spring bar "F" and the rigid bar "H."

This machine is sold by Holz & Company, 17 Madison avenue, N. Y.

NEW BUFF

A new type of buff has been placed on the market by the Bial Buff & Wheel Company, associated with the Riegel Lock Company, 8 W. 40th street, New York. The distinguishing features of this buff is that it is sewed so that most of



NEW BIAS BUFF

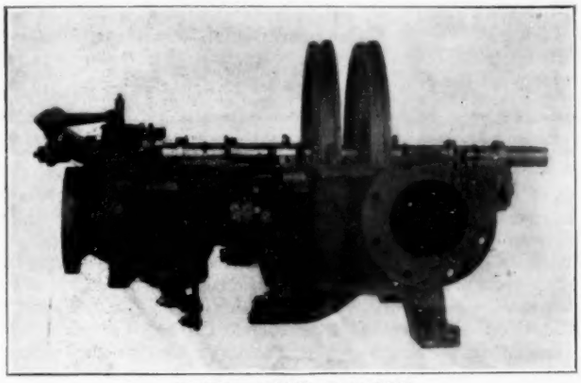
the threads emerge at much more nearly a right angle to the circumference than the average buff, and a large number are in a radial position. This, it is claimed, prevents unraveling, with its consequent waste of cloth, polishing material and labor. It is said to be balanced evenly and uniformly. This sewing is accomplished by gathering the cloth at the centre and clamping between two hubs.

*E. H. Dix, Jr., The Single Blow Notched Bar Impact Test as used in the American Industry (Proc. Am. Socy. for Testing Materials, 1919).

**Dr. W. H. Hatfield; The Mechanical Properties of Steel (Proc. Institution of Mech. Engrs., London, 1919).

NEW TURBINE

The General Electric Company has recently developed a new turbine, of the Curtis type, suitable for driving such apparatus as blast furnace and converter blowers and centrifugal air compressors and exhausters for oil, gas, or powdered coal furnaces. The turbines are of one, two, or three stages, and operate at steam pressures of from 50 to 300 lbs., with or without superheat, and either condensing or non-condensing.



CURTIS TYPE TURBINE

The turbine is constructed throughout so as to give the greatest strength and rigidity possible, and the casing is easily raised for inspection, or removal of the wheels. The steam connections are so arranged that they need not be disturbed when it is desirable to remove the top of the casing.

The turbine is equipped with speed control in the form of a centrifugal governor, and if desired an emergency governor. The first is of the centrifugal tension spring type, the motion of the weights being transmitted through ball bearing connections to the governor valve. The speed may be adjusted while the turbine is running by a simple operation of the governor valve. The emergency governor is attached, operates entirely independently of the main governor, when the speed rises to about 15% above normal.

The steam passes through the first stage nozzles, from the steam chest, the nozzles being opened, or closed, as required, by hand valves placed in the steam chest. The governors control the flow of steam to all nozzles.

NEW CEMENT FOR BRASS CASTINGS

This cement is to be used in the same manner as steel cement in blow holes, scars, etc., excepting that a special liquid, "Paxlic," is added instead of water. It will repair leaky pipes and joints and fill up small depressions in anything where it has a chance to take hold. Can be sent at once by parcel post in one and five pound packages, including sufficient liquid. The powder and the liquid are sold separately if desired. It is put out by the J. W. Paxson Company, Philadelphia, Pa.

ASSOCIATIONS AND SOCIETIES

REPORTS OF THE CURRENT PROCEEDINGS OF THE VARIOUS ORGANIZATIONS

INSTITUTE OF METALS DIVISION

The New York meeting will be held on Tuesday, February 15, 1921, at 10.30 p. m., at the Engineering Societies building, 29 West Thirty-ninth street, in room 3, on the fifth floor. Papers read will be:

Thermal Expansion of Copper and Its Important Industrial Alloys, by Peter Hidnert.

Effect of Temperature, Deformation, Grain Size and Rate of Loading on the Mechanical Properties of Metals, by W. P. Sykes.

The Hotel Seville, Madison avenue and Twenty-ninth street, is recommended for out-of-town members.

PHILADELPHIA FOUNDRYMEN

The Philadelphia Foundrymen's Association, at its annual meeting, January 12, re-elected Thomas Devlin, of the Thomas Devlin Manufacturing Company, Philadelphia, president, and George C. Davies, of Pilling & Company, vice-president. Howard Evans was re-elected secretary. W. G. Summers, of the Phoenix Iron Company, was elected treasurer. The executive committee are as follows: Walter Wood, of R. D. Wood & Company; Frank Krug, of White & Brother, Inc.; Frank Hodson, of the Electric Furnace Construction Company; Walter T. MacDonald, of the Fletcher Works, Inc.; W. T. Dunning, of the Chester Steel Castings Company; J. Howard Sheeler, of the Sheeler-Hemsher Company.

THE BRITISH INSTITUTE OF METALS

The annual general meeting and dinner will be held in London on March 9 and 10, 1921. Full particulars were mailed on February 9.

BOSTON BRANCH, A. E. S.

The Boston Branch met Friday, January 7, at the Quincy House, Boston, with President Francis Mackie in the chair. After the regular order of business, reports of committees were taken up. The banquet committee made its report, which was very favorable, and by the way the committee is working the banquet should be one of the greatest successes in the A. E. S. The permanent charter was received and a great boom in the membership of the branch is expected very soon.

An open meeting was held at the Quincy House, Boston, January 21, which was well attended. Two applications were received and referred to the board of managers. After the regular order of business President Mackie gave a talk on the analysis of solutions, how to test them, and how to keep them in working order, saying that every plater should know at least a little chemistry, with which every plater present agreed. Mr. Herrick then gave a talk on electro-plating and its relations to the manufacture of phonograph records. Discussions were held, the visitors asked questions and were answered.

NEW YORK BRANCH A. E. S.

Don't forget the banquet at the Aldine Club, 200 Fifth avenue, New York, February 19, 1921. Bring the ladies along. For details see THE METAL INDUSTRY, January, 1921.

VARNISH MANUFACTURERS

The Plant Managers of the New York and Northern New Jersey sections of the National Varnish Manufacturers' Association held their fifteenth meeting Wednesday, January 19, in New York. Mr. Frank Schumann, of Hilo Varnish Corporation, presided.

Dr. Henry A. Gardner, of the Scientific Section of the National Varnish Manufacturers' Association, presented a very interesting paper on the subject of "Lime for the Varnish Industry." It illustrated the need for research and scientific control of a subject which would normally seem to be very simple.

This was followed by a discussion of varnish specifications. The committee is making an honest effort to assist, with constructive criticism, those who are attempting to write varnish specifications.

The next meeting will be held in February. Time and place to be announced later. Subject for discussion will be: "Pitting or Pockmarking of Black Baking Japans." Every varnish manufacturer who is a member of the National Varnish Manufacturers' Association is urged to have representatives present.

INDUSTRIAL COST ASSOCIATION

The Industrial Cost Association is an association of officers and managers of industrial corporations, firms and trade associations, and employees, having executive supervision of their cost accounting. The objects of the association are as follows:

(a) To stimulate the interest of all manufacturers in correctly determined costs.

(b) To standardize cost and accounting terminology, to establish governing principles; and to simplify cost accounting.

(c) To educate members in the use and advantages of graphic charts and other modern methods of cost analysis and control.

(d) To assist members of the association who are identified with cost committees of trade organizations in formulating uniform cost methods, and to recommend to members the adoption of such uniform methods.

(e) To provide a forum for the discussion of cost problems and practices through general and local meetings; and to gather and disseminate news of interest to members.

(f) To establish a library of cost literature, and to maintain a bureau of information, through which members may be assisted in the solution of their individual cost problems.

(g) To co-ordinate the efforts of members to the end that cost production may be considered in its proper relation to the complex problems of industrial management.

Information can be obtained from A. A. Alles, Jr., secretary-treasurer, suite 1501 People's Bank building, Pittsburgh, Pa.

LIGHTING FIXTURE MANUFACTURERS

The National Council of Lighting Fixture Manufacturers is an organization formed to assist manufacturers of fixtures, fixture-parts and glassware to promote the good of the industry as a whole and to co-operate with each other for the solving of their own collective problems. Only manufacturers of lighting fixtures, fixture parts, table-lamps, portables, reflectors and lighting specialties are eligible.

The history of the National Council is briefly as follows: It was formed in February, 1919, with a membership of twenty manufacturers. At the meeting in Cleveland, August, 1919, at which time the members were thirty-five in number, the by-laws were adopted. The first Annual Convention (February, 1920) was held at Detroit, Mich. In conjunction with this convention, a fixture market was held to enable the dealers to inspect the latest developments in the lighting fixture industry and to make their selections, from the goods displayed, for the coming season.

The names of the officers for 1920 are: F. R. Farmer, president; William Horn, vice-president; Charles H. Hofrichter, secretary-treasurer. Executive Committee—M. D. Blitzer, Herman Plaut, Arthur Polacheck, E. F. Guth, B. F. Klein, D. C. DeLancey.

The Second Annual Convention and Fixture Market is to be held at the Elmwood Music Hall in Buffalo, N. Y., February 14-19, inclusive, 1921.

Particulars concerning the convention of the National Council of Lighting Fixture Manufacturers should address Charles H. Hofrichter, 8410 Lake avenue, Cleveland, Ohio, the Secretary-Treasury of the National Council.

ENGINEERING STANDARDS COMMITTEE

As a result of a year's experience, during which progress has been made on each of about 40 standardization projects, the American Engineering Standards Committee has completely redrafted its Rules of Procedure. The most important changes are explicit recognition of the representations of organizations as such in the make-up of the working ("sectional") committees, and the introduction of a greater flexibility into parts of the rules.

The American Engineering Standards Committee, generally spoken of as the Main Committee, does not concern itself with the technical details of standards. The formulation of any particular standard is in the hands of a working committee, called a sectional committee, which is made up of representatives designated or approved by the various bodies, technical, industrial, etc., concerned in the standard. The personnel of the sectional committee must be approved by the Main Committee as being authoritative and adequately representative of the industry, and of the various bodies concerned, producers, consumers and general interests must be represented upon all sectional committees dealing with standards of a commercial character.

In one important particular the procedure differs from that of other national standardizing bodies. Sectional committees are organized, not by Main Committee, but by one of the principal bodies interested, designated for the purpose by the Main Committee, and termed the sponsor for the particular project. A body may act as sponsor whether it is represented on the Main Committee or not, and two or more bodies may act as joint sponosrs for a project.

There are now 47 members of the committee, representing 17 member bodies. In all, 24 organizations are represented on the committee, as three of the member bodies are groups of organizations.

Copies of the revised rules may be obtained by addressing a request to the American Engineering Standards Committee, 29 West 39th street, New York City.

PERSONALS

ITEMS OF INDIVIDUAL INTEREST

L. M. Graham, well known among the A. E. S. and the plating trade, has left the Connecticut Dynamo and Motor Company to go with the General Supply Company of Cleveland.

M. I. Doyle, formerly with the sales department of the U. S. Electro Galvanizing Company, Brooklyn, N. Y., is now in charge of sales for the Bias Buff and Wheel Company, New York.

E. E. Berlinger and **S. F. McElroy** have severed their connection with the Michigan Smelting and Refining Company, of Detroit, Mich., and are now located at 1111 Superior Viaduct, Cleveland, Ohio, where they are ready to receive inquiries on all non-ferrous metals and compositions.

Charles Mack, foundry superintendent for the American Foundry Company of Newark, N. J., resigned January 1, 1921, and went with the Westinghouse Electric and Manufacturing Company at the Essington, Pa., plant to take charge of the brass foundry department. Mr. Mack has been in foundry work for 23 years and for the past 18 years has been in charge of the foundries with which he has been connected.

Hugh R. Corse, who, for the past six years, has been general sales manager of the Titanium Bronze Company, has been elected to the staff of the Lumen Bearing Company, Buffalo, N. Y., in the capacity of sales engineer. Mr. Corse enjoys a large acquaintance with the executives and engineers of the automotive industries, as well as with the machine-tool industry. Also, he is not unacquainted with the Lumen Bearing Company's products, for prior to his connection with the Titanium Bronze Company he was in charge of their district sales office in Detroit for a period of five years.

DEATHS

WILFRED C. SLY

W. C. Sly, president of the W. W. Sly Manufacturing Company, Cleveland, O., was shot and killed by bandits who, in a daylight robbery, also killed George K. Fanner, plant superintendent, and escaped with $4,200 of the payroll. A fake collision was staged to block the Sly automobile. When the officials got out of their car they were shot down. Several held in connection with the murder and theft have been freed for lack of evidence.

Mr. Sly had been connected with the Sly Company nearly all

of his business life, and had been president for 10 years; he was for several years director of the Industrial Association of Cleveland.

Mr. Sly, 58 years old at the time of his death, was the son of W. W. Sly and Mary Banks, natives of New York state who had settled in Michigan shortly after they were married. He remained in Michigan for some years and then was taken to Cleveland. He had been in that city ever since.

Having finished a high school course Mr. Sly started as a helper in the Cleveland Nickel Works, a small shop conducted by his father. He assimilated the details of the business and gradually enlarged the scope and extent of the company's activities to include core ovens, tumbling machinery, sand blast installations, cupolas, fans, dust arresters, and sand reclaiming equipment. He was vice-president and general manager for several years and on the death of his father he was elected president. Under his direction the business of the company expanded to such an extent that the old plant was outgrown. Large new buildings recently have been erected and equipped with the most modern machinery, increasing the capacity of the plant about 300 per cent.

Mr. Sly was one of the oldest in point of membership of the Cleveland Yacht Club. He was an enthusiastic member and chairman at various times of important committees appointed by the Industrial Association of Cleveland. He was a strong believer in more harmonious relations between employee and employer. He is survived by a widow, whom he married on April 18, 1894, and also by his mother and one sister, Mrs. E. C. Hoffman, all of Cleveland.

GEORGE K. FANNER

George K. Fanner was murdered by bandits with W. C. Sly. He was the son of G. J. Fanner, founder of the Fanner Manufacturing Company, Cleveland, but for the past 12 years vice-president of the W. W. Sly Manufacturing Company. The young man started with the company as a machinist and gradually advanced to the position of superintendent, a position he held at the time of his death. He is survived by a widow and one daughter.

GEORGE B. KERR

George B. Kerr, Sr., Chicago agent of the Scovill Manufacturing Company, died at Montgomery, Ala., December 26, 1920. Mr. Kerr entered the employ of the Scovill company on March 1, 1868, as office boy in the main office at Waterbury. His rise was rapid. He was for a time at Boston as assistant to Allen G. Lovell. Following the death of Ezra H. Patterson, the company's representative in Chicago, Mr. Kerr, in 1887, was assigned to that office, a position he held until his death. He has been with the Scovill company 52 years, and on the occasion of his golden anniversary " in harness" his local staff presented him with a solid silver loving cup. He was born in Franklin, N. Y., in 1849. He has two sons, who are also connected with the Chicago office of the Scovill company.

HUGH N. CAMP

Hugh N. Camp died January 24, 1921, at his residence, 150 West Fifty-ninth street, New York, at the age of 52. He was born at Morris Heights on November 13, 1867, and was a son of the late Hugh N. and Elizabeth McKesson Camp.

Mr. Camp was vice-president and treasurer of the St. Joseph Lead Company and treasurer of the Five Points House of Industry. He was a member of the Union, Union League, Racquet, Recess, Riding, Rumson and Seabright Beach clubs and a veteran of Company K, 7th Regiment. He leaves a wife, who was Candace E. Quinby, daughter of Henry B. Quinby, ex-Governor of New Hampshire; one sister and two brothers, Edward B. and John McK. Camp.

HARVEY CLAP

Harvey Clap, one of the oldest and most respected citizens of North Attleboro, Mass., died Saturday evening, January 15, at his home in Mount Hope street, that town. He had been in failing health for several months past. He was born in Walpole, Mass., and when a young man removed to North Attleboro, where he learned the manufacturing jewelry trade and later became associated with the late Homer Daggett in the manufacture of jewelry. At the time of his death he was the head of the Harvey Clap Company, of Attleboro. He is survived by a wife and three sons.

BERNARD FISHER

Bernard Fisher, 73, founder of the Atlas Brass Manufacturing Company, Cleveland, died at his home, January 15. Mr. Fisher had been a resident of Cleveland since 1872. Fifteen years ago he established the Atlas business with his sons—S. P., George, Jack, Ralph and Sidney. Mr. Fisher was general manager, and active in the company's affairs until a short time before his death. The Fishers are interested in the Regent Brass Foundry, Marysville, and the Delaware Brass Works, Delaware.

TRADE NEWS

BUSINESS REPORTS OF THE METAL INDUSTRY CORRESPONDENTS

WATERBURY, CONN.

FEBRUARY 1, 1921.

Under a bill recently offered in the State Senate of Connecticut, the **Scovill Manufacturing Company,** of Waterbury, seeks authorization to increase its capital stock to $25,000,000, divided into shares of $100 each. The present capital of the company is $5,000,000. The bill was referred to the committee on incorporations along with a similar bill introduced in behalf of the **Yale & Towne Manufacturing Company,** of Stamford. The Scovill Company, according to General Manager **John H. Goss,** is operating under a special charter, and it is therefore necessary to go to the State Legislature to get permission to increase the company's capital stock. The bill is the result of plans laid two years ago, Mr. Goss said in a statement, and is intended to take care of any future growth of the company. No plans of plant expansion are contemplated at present, he said.

The general business depression is being felt at this time in Waterbury, as elsewhere. The lack of full time work is reflected in the business of local merchants, although a general tone of optimism is fostered to considerable extent through the newspapers. A month ago the estimate secured through sources considered reliable indicated that about 20 per cent. of the workers of this city were without work of any kind. Other curtailments in wages and hours were also in effect. Additional layoffs have been reported since then, although definite figures are not available. Public spirited organizations composed chiefly of influential business men are doing what they can to reduce costs of living. The Scovill Company has established a store for its employees at which food, and some classes of clothing, may be purchased at cost. A committee of the Rotary Club recently scoured the city in search of dead trees. These were charted and permits to cut them were issued to citizens in need of fuel. The city benefits, also, as unsightly dead chestnut trees which have been an eyesore since the blight of several years ago, are being rapidly cut down and taken away.

The Scovill Manufacturing Company's Foremen's Association held their annual dinner in this city on January 22. Edward O. Goss, president of the company, made a brief address in which he urged conservation, and a utilization of efficiency. He also urged the taking of "personal inventories," the taking of careful estimates of each one's abilities. He said that before the depression everyone looked into a mirror that was too flattering. Then came the other extreme

and everyone looked into a mirror which showed too gloomy a view. Now a mirror is beginning to show things as they really are, he said, and the country is reaching a sounder basis.—H. G. N.

NEW BRITAIN, CONN.

FEBRUARY 1, 1921.

New Britain's metal manufacturing industries, without a single exception, are now experiencing the most disastrous business slump that has occurred in a generation. Not a single factory is working on full time, in no case is the full complement of men being employed and there is not a factory that has not felt compelled to cut the wages of the men who are still retained. This is the condition that both capital and labor faces in this city, the center of the hardware manufacturing business of the world. Where previously orders were sent in for gross amounts, now they are for individual items. All of which is attributed to the general tendency of a falling market, buyers not wishing to stock up on any line of goods until the bottom has been reached. Concerning the immediate future there seems little likelihood of any change for the better. Those in a position to know do not appear as optimistic as they did when the slump first started. Then they were almost positive in their predictions that springtime would see a rush of orders and a stimulated trade. Today this erstwhile prediction is put forth as a hope. "If spring sees a resumption of the building business, then we will again be on our feet," is what the general opinion is today.

The **Fafnir Bearing Company** was compelled to close entirely about the middle of last November and has not since resumed operations. This, being dependent upon the automobile industry, cannot hope for business until the big motor concerns again start operations. The **North & Judd Manufacturing Company** went onto a 24-hour week not long ago, but this week increased its working schedule to 32 hours a week. There has also been a 10 per cent wage cut at this plant, and the same is true at the **Traut & Heine Manufacturing Company,** which is working but 32 hours a week.

The **Stanley Works** and the **Stanley Rule & Level Company,** one of the biggest combines in the east, has curtailed its working force and has also cut the pay of its employees approximately 10 per cent. **Landers, Frary & Clark** have also instituted a systematic curtailing of employees, both in the office and factory, and likewise have cut wages. The **P. & F. Corbin** division of the **American Hardware Corporation** has dropped from a 55-hour week to a 40-hour week and has not only abolished the bonus system, but also has reduced the wage rate about 10 per cent. At the **Corbin Screw Corporation,** of the same combine, a 10 per cent wage cut has been put into effect, though the factory is maintaining a 50-hour week. The **Russell & Erwin Branch** of the American Hardware corporation is feeling the slump very badly. Several departments are on a 30-hour working schedule and wages have been reduced 10 per cent. Running the Fafnir Bearing company a close race for discouraging reports is the New Britain Machine Company. This is in the throes of a slump that has practically closed down the entire plant.

It appears that in New Britain the same conditions are reflected as practically everywhere else. Business is admittedly bad. The future is uncertain and the great hope is for a revival of building business in the spring.—H. R. J.

TORRINGTON, CONN.

FEBRUARY 1, 1921.

The new town grand list just completed shows that the principal factories of Torrington are assessed as follows: American Brass Company, $3,930,845; Torrington Company (Needle and Standard plants and Maiden lane property), $2,165,831; Hendey Machine Company, $985,202; Union Hardware Company, $785,163; Turner & Seymour Company, $447,622; Warrenton Woolen Company, $357,750; Progressive Manufacturing Company, $278,417; Hotchkiss Brothers Company, $269,466; Torrington Manufacturing Company, $202,575; Fitzgerald Manufacturing Company, $96,595.

James A. Doughty has been re-elected president of the Maria Seymour Brooker Memorial, the institution founded in Torrington by Charles F. Brooker, as a memorial to his mother.

Announcement was made during the past month that beginning January 1 the Torrington plant of the **American Brass Company** was to be known as the **Torrington Branch** and not as the **Coe Brass Branch.** At the same time the **Benedict & Burnham** and **Waterbury Brass** plants were consolidated under the name of the **Waterbury Branch.**

The **Torrington Branch,** originally the **Wolcottville Brass Company,** became the **Coe Brass Company** in 1863, when the late Lyman W. Coe acquired full control; and the name of Coe was retained in 1911, when the plant was merged with the other subsidiaries of the **American Brass Company.**

At the annual meeting of the Torrington National Bank held during the past month, **John A. Coe,** president of the American Brass Company, was elected a director to fill the vacancy caused by the retirement of **F. P. Weston,** of the Torrington Company, who was unable to serve longer owing to ill health. **Frank M. Travis** was elected president to succeed **Frederick F. Fuessenich.**

The annual report of the **Hendey Machine Company** has been filed with the town clerk. It shows the following officers: president and treasurer, Charles H. Alvord; vice-president, Robert C. Swayze; assistant treasurer, Frederick W. Fuessenich; assistant secretary, John Jack; directors, Frederick F. Fuessenich, Charles H. Alvord, Robert C. Swayze, and Frederick W. Fuessenich, of Torrington; William E. and William S. Fulton, of Waterbury, and Charles S. Palmer, of New Haven.

Notices of a twenty per cent reduction in pay, effective January 10, were posted early in January in the **Excelsior Needle, Progressive Manufacturing, National Sweeper** and **Standard** plants of the **Torrington Company.** The reduction affected all workers, whether on salary, day or piece-work basis.

At a meeting of the directors of the **Community Cooperative Company,** Walter Harrison, representing the American Brass Company group of stockholders, was re-elected president. J. G. Lakin, of the Hendey Machine group, is vice-president; E. T. Overton, of the Standard group, treasurer, and John Whalen, of the Turner & Seymour group, secretary.

Compensation Commissioner Williams has given a supplementary decision in the case of Frank E. Dunne, of Torrington, against the Fitzgerald Manufacturing Company. On November 16, 1920, Commissioner Williams made an award that the company should pay $6.57 a week during the period of total incapacity and $9.86 per week for 156 weeks thereafter. The respondent filed an appeal and under the new decision the lump sum of $2,750 is awarded. This was the case in which the claim for compensation was opposed on the ground that Dunne was injured while repairing a belt for another worker, which, it was alleged, was not in the course of his regular duties.—J. H. T.

TRENTON, N. J.

FEBRUARY 1, 1921.

The development of the production of zinc oxide promises a new and great industry for Trenton. For several years the **M. M. & S. Metal Company,** with a plant at Fall street and Commercial avenue, has been manufacturing zinc oxide. The business grew until last year 2,000,000 pounds of zinc oxide was manufactured at big profit. The demand, however, was greater than the company could supply with its present capacity and equipment and the **Trenton Zinc & Chemical Company** was recently organized by a number of prominent business men of Trenton for the purpose of taking over the metal company and enlarging and developing the present plant and equipment to meet existing requirements for production. When the proposed development is made the present plant of the company will have a capacity of 12,000,000 pounds of zinc oxide a year. The company has contracts for the output of mines in Salem, Kentucky. The officers of the new company are: President, Max Mov-

shovitz; vice-president, A. Dayton Oliphant; secretary, Robert F. McGrory; treasurer, Edward B. Fulper.

The **L. R. Waterman Company,** fountain pen manufacturers, have closed a deal which will transfer the property of the General Phonograph Company in Thomas, street, Newark. The property includes a modern factory building. Part of the phonograph company's equipment will be moved to another plant owned by the company at Elyria, O., and a portion of the Newark plant will be rented from the Waterman company to be used for the manufacture of records. The building is a five-story structure and contains 250,000 square feet of floor space.

E. W. Miller, Inc., of 473-75 Washington street, Newark, has been incorporated at Trenton with $25,000 capital to manufacture jewelry. The incorporators are: Everett W. Miller, 786 Bergen street, and Harry R. and Florence A. Kneezel, of 105 South Grove street, East Orange.

C. A. Goldsmith Company, 270 Thomas street, Newark, has been incorporated with $200,000 capital, to engage in the manufacture of metals. The incorporators are: Frederick W. Smith, William D. Goldsmith and Arthur D. Goldsmith.

Universal Safety Lock Company, of Paterson, has been incorporated at Trenton with $100,000 capital, to make patent locks. The incorporators are: Antonio Caputa, R. H. Graeber and Matteo Tamburini, all of Paterson.

Balbach Smelting and Refining Company, Wilson avenue, Newark, will erect a steel machine storage building, one story, 50 by 30 feet, and a steel ice storage building, one story, 20 by 76 feet, to cost $5,800.

Federal Judge Lunch, of the United States District Court, has appointed Harry E. Ackerman, John S. Dickerson and Middleton L. Borland as ancillary co-receivers of the **American Tin Smelteries, Inc.,** of Matawan, N. J. The bond of each man was fixed at $5,000. Dickerson and Borland are officers of the Smelting company. On December 23 the company filed a voluntary petition of bankruptcy in the United States Court of the Southern District of New York, representing its assets at $90,213.63, and its liabilities as $180,664.89. Its New York office is at 10 Wall street.

The **Arnold-Hellmuth Manufacturing Company,** of Brooklyn, manufacturers of metal parts, have leased for a term of years the property at 164 Emmett street, Newark, for factory purposes.

Circle Stamping & Manufacturing Company, Belleville, N. J., manufacturers of plate washers and general stamping work, have taken over the building recently vacated by the American Perforated Metal Company, 245 Cortlandt street, Belleville.

The **American Stamping Company,** Elizabeth, N. J., was recently organized to take over the partnership operated under the same name. The company manufactures toys and novelties and sheet metal products. The officers are: President, E. W. Phares; vice-president, Clark McK. Whittemore; secretary, G. M. Seaton; treasurer, H. A. Hills. The office of the company is at 309 Pine street, Elizabeth.—C. A. L.

PROVIDENCE, R. I.

FEBRUARY 1, 1921.

The month of January has been the dullest month in a long time among the metal industries of Rhode Island. Where for the past five years there has been a pronounced dearth of men, there is now a more decided dearth of work, with prospects of any immediate improvement far from promising. The industrial depression that has shaken all lines of business has left its mark heavily upon the various branches of the metal trades and it is several years since there was so large a number of metal workers out of employment.

So diversified are the mtal industries of Providence and vicinity that usually when one branch is dull the others have business enough to keep them busy. But the present situation appears to include every branch, whether light or heavy work or whatever metal. Even the iron workers are now out of work for the first time since the war first began. All lines of the jewelry industry are also among those shut down, although January closes with a more optimistic feeling among the manufacturers of jewelry than existed at the beginning of the new year. A number of buyers from different sections of the country have been in Providence during the past month, and while individual orders have not been large the total has been sufficient to give a slight impetus to the jewelry producers. This, with the preparation of new lines of samples that is always in order at this season, gives some stimulus.

One branch of the jewelry industry that has been very busy is the refining. But this is a natural sequence, for whenver business is dull the manufacturers embrace the opportunity to clean up shop, and this affords the refiners their opportunity of getting busy. Several of the refining concerns have recently altered their plants so as to secure more space and facilities for the handling of their increasing business and noticeable improvements have also been installed. Several coloring establishments have also been increasing their facilities in preparation for a revival of the general jewelry business that is expected to materialize before the end of the first half-year.

W. O. & M. W. Talcott, Inc., of Providence, has been incorporated under the laws of Rhode Island for the purpose of manufacturing belt hooks, with an authorized capital stock of $50,000 of 500 shares common at $100 each. The incorporators are Walter O. Talcott, Manuel W. Talcott and Luther C. Freethly, all of Providence.

Cannon & Brown, Inc., have materially enlarged their electro-plating establishment at the corner of Eddy and Friendship streets and entirely rearranged their plant, affording increased facilities for their constantly increasing business. Among the more noticeable changes is the arrangement of the office whereby entrance to the plant is at 185 Eddy street, instead of at 78 Friendship street as previously.

William A. Henry, who has been secretary, assistant treasurer and general manager of Hutchison & Huestis, Inc., manufacturers of gold rings at 116 Chestnut street for the past six years, has resigned. He has purchased a half interest in the H. J. Deyell Refining Company, 79 Sabin street, and the firm name has been changed to Deyell & Henry.

Conley & Straight, refiners, have enlarged their general offices by taking over the considerable space in the refinery formerly utilized as the lacquer and chemical departments. This additional space will afford ample room for private offices for both partners, as well as commodious quarters for the general office.

J. B. Granger Company, enamelers and enamel manufacturers, have removed from Clifford street to 155 Chestnut street, where the firm has recently purchased the building and altered it to meet the requirements of their business. The workroom has silver coloring and dipping tanks, enameling appurtenances and other appliances and equipments for the business. The second story of the building is used as a stock room and for storage.—W. H. M.

ROCHESTER, N. Y.

FEBRUARY 1, 1921.

There has been little or no change in the business situation among metal-using manufacturing institutions in Rochester since the first of the new year. In fact it was not anticipated that there would be. The annual inventory season, coupled with the peculiar industrial adjustment conditions prevailing throughout the entire country, has had the effect of keeping production down in Rochester, as well as elsewhere Several thousand employees of metal-using plants are idle in this city, but it is expected that within the next thirty days a change for the better will have arrived.

Many of the larger concerns have taken advantage of the temporary dullness to stock up their warehouses, and considerable metal is being shipped into the city. Much copper and brass was added to stocks in the city since the holidays, while lead, tin and aluminum supplies have been enlarged.

Rapid freight service in and out of Rochester is now in effect and is greatly appreciated. Manufacturers say shipping facilities between this city and New York and Buffalo have been improved 50 to 100 per cent. since January 1. The new service, of course, applies to carloads of high-grade freight, or package freight, which is classed as merchandise freight.

The **Willsea Machine Works** has increased its capital stock from $250,000 to $350,000, by adding $100,000 of 8 per cent. preferred stock. Employees have been given an opportunity to purchase this new stock, payable in instalments. The Willsea company announce that it will continue to operate as an open shop.

The purchase of the large **Remington Arms** plant in Bridgeport, Conn., by the **General Electric Company,** will have no effect on the operation of that corporation's Rochester plants. Because of the business depression both plants in this city are shut down for the time being. One plant manufactures motors for washing machines, while the other plant makes a larger motor.

Plans are now under way for a campaign against the open-shop movement by labor organizations in Rochester. These various labor groups are said to represent 26,000 workers in Rochester. Many independent unions are identified with the movement, but no talk of strikes is heard.

Reports from the superintendents of the various plating shops about the city indicate that business is exceptionally quiet at this time, and the prospects do not promise renewed activity before spring.—G. B. E.

INDIANAPOLIS, IND.

FEBRUARY 1, 1921.

The **Indiana Aluminum Ware Company,** of Elkhart, Ind., has increased its preferred capital stock from $200,000 to $250,000.

The **McNamara Koster Foundry Company,** of Indianapolis, Ind., has increased its capital stock from $10,000 to $75,000.

Three hundred employees of the Grasselli Chemical Company's plant were thrown out of work recently at Terre Haute, Ind., when the plant closed down for six months and probably for an entire year, because of a lack of demand for pig spelter, one of the principle products of the plant. No one will be about the plant but the superintendent and watchman. The plant has experienced several strikes among the workmen during the past twelve months, which has handicapped the output when there was a market for zinc.

The first of the year saw several foundries throughout the state reducing their pay schedules. Among them was the Columbus Foundry Company, of Columbus, Ind., just south of Indianapolis. Wages of laborers were reduced sixteen and two-thirds per cent. Molders, however, were not reduced.

Foundrymen about Indianapolis have, generally speaking, weathered the storm of financial depression (followed by an industrial depression), in good shape. In only a few instances were large numbers of men laid off and in those plants where production was curtailed because of lack of demand, the prospects are bright for a general resumption of business. In many of the large automobile plants here the smaller castings and special parts are made at outside plants and the plants which held heavy contracts for automobile parts were the ones hurt the most. It is generally predicted that the automobile plants will be in operation at least by the middle of February. In case this happens, the foundries will benefit in direct proportion.

The **Acme Aluminum and Brass Works,** of Indianapolis, has filed a final certificate of dissolution with the secretary of state.—E. B.

CLEVELAND, OHIO

FEBRUARY 1, 1921.

First month of the new year marks fulfillment of the prediction that "after the first of the year business will be better." To point out just how business is better would be a difficult matter. There is a better feeling in commerce and industry here, and it is certain that inquiries for materials, machinery and the like are better. Actual orders, however, are few and far between. Labor still is in the surplus stage, as industrial establishments here have laid off considerable numbers. It is conservatively estimated that 80,000 men are out of work. It is true that some establishments are resuming operations after a shut down of weeks, or months. On the other hand plants that have been operating right along have shut down, in part at least. The buying power of the community is decidedly reduced.

One of the first cuts in the metal industry is being put into effect by brass manufacturing concerns here. This is for a 10 per cent reduction in wages, and a nine-hour day. The move concerns members of the **Cleveland Brass Manufacturers Association,** according to **Phil Frankel,** secretary. The new schedule calls for 80 cents an hour, and affects 500 operatives. Question of organization of labor does not enter into the move, as in such instances where plants have been closed all men who wish to return at the new scale of wages and hours will be employed. The **Sterling Brass Company** is operating non-union, according to **S. L. Weil,** president, and will not be affected by any union dispute.

One of the largest automobile plants in town, the **White Company,** and the last to make any drastic changes in operation, has cut its working week to four days. This change goes into effect February 1. Lack of orders is given as the cause.

The **Fulton Foundry and Machine Company** has been purchased by a company headed by **C. L. Bradley,** of the Union Commerce National Bank, which will operate the property.

Damage to the extent of $3,000 was done to the plant of the **Johns Machine and Stamping Company** when a japanning oven exploded from overheated gas. No one in the plant was injured.

The **Equipment Manufacturing Company,** Conneaut, which was idle for two months, has resumed operations.

An attempt to rob the safe in the offices of the **Advance Engineering Company** failed when safe crackers sought to use an acetylene torch. A hole was bored into the safe near the combination, but the heat melted the tumblers and blocked the job.

Following a second fire in less than a week, the last of which destroyed a building, fire wardens are looking for incendaries. The fire damaged the **Walworth Run Foundry** to the extent of $4,000. It is the belief of President **Albert Gerdum** that boys or tramps started the blaze.—C. C. C.

ROME, N. Y.

FEBRUARY 1, 1921.

The close of January found business conditions in the metal industry plants of this city gradually improving. Some of the shops are working full time and none are working less than three day a week. No change in wage schedules has been reported and no talk of a change is heard.

Annual meetings of stockholders of a number of the factories have already been held. **Barton Haselton** has again been elected president and general manager of the**Rome Brass & Copper Company,** and **Frank J. DeBisschop** heads the **Rome Hollow Wire and Tube Company** as president and general manager of that fast growing industry. **H. T. Dyett,** president and general manager of the **Rome Wire Company,** has also been chosen president of the **Halsted Wire Company.**—M. J. D.

DETROIT, MICH.

FEBRUARY 1, 1921.

Like all other manufacturing centers, Detroit is passing through a great industrial depression. But conditions have begun to show a decided improvement within the last week. The **Studebaker Corporation** has begun to take on more men and increase production. The **Ford Motor Company,** which closed for inventory December 24 for a week, as it was announced at the time, and still is practically at a standstill, announced yesterday that it would resume Monday with about 25 per cent of its old force of 50,000 men. It also was announced that the **Ford Tractor** plant at the western end of the city would resume operations Monday, full force. One Ford official is reported as saying that the plant would continue to produce as long as the people would buy automobiles. From that it is inferred that production will be increased as demand occasions. With the automobile plants resuming the accessory plants also will resume, and this means a revival of the brass and aluminum industry.

The **Burroughs Adding Machine Company,** which normally employs 12,000 persons, has continued to produce right along, but is reported carrying only about 8,000 on its pay rolls. This company operates one of the largest plating and enameling departments in the city.

There is practically nothing doing in the manufacture of plumbing supplies. The same also is true in the general brass business.

The future, of course, is more interesting just at present. "When will business resume normally?" every one asks. Well, that is another question. No one knows, but judging from the general aspect of things, there is going to be a decided change for the better along about April or May. That is what manufacturers are banking on, and it looks very much that way. In the meantime everyone is making the best of things.

It is very gratifying to say, notwithstanding the extreme depression and the fact that it has been with us for a number of weeks, there have been no failures of consequence.—F. J. H.

BIRMINGHAM, ENGLAND

JANUARY 24, 1921.

The end of the year sees British industry in a state which forms a sad contrast to the conditions of a year ago. Instead of being overwhelmed with orders and being able to make their own terms with buyers at home and abroad, manufacturers in most trades are now short of work and many of them, owing to the tightness of money, are compelled to unload stock at a sacrifice. The total number of men and women out of employment exceeds a million, whilst many others are only kept at work by running the factories for half or even one-third the normal week. Relief funds have been opened in the big manufacturing towns and the government and local authorities are organizing road-making and other schemes in order to provide some employment.

The non-ferrous metal industries, which continued fairly busy for a long time after the iron and steel and engineering industries had been feeling the increasing depression, are now beginning to share it. Brass founders have had many foreign and home orders cancelled during the last few weeks. The cabinet brass foundry trade, which, up to the autumn, was doing a good business with India and other overseas markets, is the most seriously affected. Foreign business is approaching the vanishing point, whilst a standstill in the erection of buildings of the better class has brought home business to a very low ebb. In gas, steam and water fittings things have not been quite so bad. A good market is known to exist in Australia for such goods, but cargo space is short, and payments, owing to the prohibition of the export of gold, are difficult to arrange. During the past week or two, there has been a slight improvement in this matter. A few of the cancelled orders have been renewed. A general improvement, however, is not expected until February when shipments of crops from Australia will commence.

A further cause of unemployment in the brass trade is the slump in motor car business. Some of the Coventry firms are working only half the week. The auxiliary trades are consequently suffering. Aluminum casting firms, which a few months ago were refusing work, are now running on short time. The aluminum hollow-ware trade is complaining bitterly of dumping from Germany, and, in view of declining selling prices, are holding up new developments for which they had been preparing. Hollow-ware manufacturers generally are overstocked and, in face of German competition, have had to reduce prices and cut down production. In galvanized hollow-ware particularly, price cutting is rife. The galvanized corrugated sheet trade is almost stagnant. Though selling prices have fallen during the year about 40 per cent very few orders are obtainable. Spelter has fallen to a price £20 per ton lower than that at which it can be produced in this country.

Electro-platers continue fairly busy, chiefly with home and export orders for hotels, clubs, etc. The spoon and fork trade is particularly well employed. Jewellers have found a little stimulus in the Christmas trade, but the buying has been far below the scale of former years. A great many firms are working only half time or less. H. & G.

MONTREAL, CANADA

FEBRUARY 1, 1921.

In view of the fact that there has not been any general movement in brass goods this month the different manufacturing concerns have reduced their working hours. Buying of course is still going on, but in such a way as to emphasize that nothing but what is required for immediate needs is being purchased. Some of the plants are running full time in getting out unfilled orders.

The manufacturers look for a gradual return to more active business, but feel that consumers will remain out of the market until the last minute in the hope that better prices will obtain. Reports from the outside in the scrap metal market state that business is slowly improving, but there has been nothing to show that the old metal market is back to normal.

The entire plant of the **W. R. Cuthbert Company,** 41 Duke street, was destroyed by fire on the night of January 13, which originated on the upper floor of the three-story building where the metal melting furnaces were located. **A. T. Cohen,** who represents a partnership in the business, states the plant will be rebuilt and new machinery installed. One of their greatest losses was a 35-years' accumulation of patterns. The damage to the building has been appraised at $35,000, and the loss of machinery and tools the same, while the stock destroyed was valued at $45,000.

The **Eugene F. Philips Electrical Works, Ltd.,** are proceeding immediately with the construction of a copper rod rolling mill having a capacity of 100 tons per day. In the design of the mill provision has been made to allow for the extension of the rolling of copper sheets and drawing copper tubes as well as the erection of a small refinery to take care of the copper scrap from the mill, together with the scrap from their wire and cable plant. For the immediate future the Phillips Company will have to import their electrolytic copper wire bars, but they are hoping that in the course of a few years these wire bars will be produced in Canada in sufficient quantities to make the electrical industry in the Dominion self-supporting as far as copper is concerned.—P. W. B.

VERIFIED NEWS OF THE METAL INDUSTRY GATHERED FROM SCATTERED SOURCES

The annual sales conference of the **Dodge Sales and Engineering Company,** of Mishawaka, Indiana, was held at the Mishawaka Hotel, in that city, January 19 to 21.

The **Bridgeport Brass Company,** Bridgeport, Conn., has offered its plant, known as the Standard Brass and Copper Tube Company, in New London, Conn., for sale.

Owing to the difficulty of securing money under present conditions the **Standard Parts Company,** Cleveland, Ohio, will continue under a receivership until such financing can be effected.

The American Humane Society, Albany, N. Y., is offering a prize of over $1,000 for the most satisfactory horseshoe or device which will prevent horses from slipping on roadways and wherever in service.

The Adamson Manufacturing Company, East Palestine, O., has added a new department for manufacturing all kinds of storage, pneumatic and pressure tanks, welded pipe, battery casings, evaporators, condensors and a large line of arc-welded products.

The Bergen Point Brass Foundry, 161 Hobart avenue, Bayonne, N. J., is making plans for increased business in the near future. They do jobbing work, and also specialize in chandelier castings and aluminum work. Albert W. Lindberg, 125 West Sixth street, heads the company.

The City Brass Works Company, 1742 Carroll avenue, Chicago, Ill., has been incorporated, with a capital of $50,000, by Arthur Tausch, Albert Grosskopf and Peter Cederstrom, to manufacture brass, bronze and other metal products. They operate a brass machine shop and polishing department.

The Keeler Brass Company, Grand Rapids, Mich., has increased its capital from $250,000 to $1,000,000. This company operates brass and bronze foundries, a brass machine shop, tool room, casting shop, cutting-up shop, spinning, stamping, plating, polishing, japanning and lacquering departments.

The business which **C. A. Goldsmith,** 270 Thomas street, Newark, N. J., has conducted for the past 30 years, manufacturing brass, bronze and aluminum castings, has been incorporated under the name of the C. A. Goldsmith Company, with a capital of $200,000. It includes a brass, bronze and aluminum foundry.

The Morris Metal Products Company, Bridgeport, Conn., has awarded contracts for the erection of additions and the making of alterations to its foundry. They operate a smelting and refining department, brass, bronze and aluminum foundry, brass machine shop, tool room, stamping, plating, polishing, and japanning departments.

The Reading Pattern Works, Reading, Pa., has completed the erection of a pattern shop, which is a wood, brick and concrete structure, with steel beams, two stories, 60 x 116 feet. The first floor will be used as an office, rest and locker room, and provide storage facilities. The second floor will be used for the manufacture of wood and metal patterns.

The E. S. Bryant Pattern Works, Ltd., Windsor, Ont., has been incorporated with a capital stock of $40,000, to manufacture patterns and to do a general foundry and machine shop business. The incorporators are Ellsworth S. Bryant and Edward J. Mamer, Detroit, Mich.; Frederick G. Loeffler, Windsor, Ont., and others.

The U. T. Hungerford Brass and Copper Company, 80 Lafayette street, New York City, announces the establishment of a Monel Metal Department, in charge of John J. Dillon, who for eight years has made a specialty of this metal and its products. They are prepared to take orders for sheets, rods, wire, rivets, bolts and nuts; wire and screen cloth; welded tube, forgings and other specialties.

A. P. Munning and Company have opened an office at 1412 Majestic building Milwaukee, Wis., in order to satisfy an insistent and growing demand for representation in the city of Milwaukee and surrounding territory for the Munning Products. The office has been placed in charge of R. J. Hazucha, who, by virtue of long practical experience, is well fitted to serve the users of polishing and plating apparatus and supplies.

The National Bronze and Aluminum Foundry Company, Cleveland, Ohio, have just placed in operation their new plant, covering approximately 70,000 square feet of floor space, and devoted exclusively to the manufacture of sand-moulded brass and aluminum castings. In addition to this they have ten acres to provide for future expansion. They have been in operation for the past fourteen years, and their new plant is one of the largest of its kind.

Several hundred thousand dollars in stock is given outright to **Calvin H. Nealley,** vice-president and general manager of the **Eastwood Wire Manufacturing Company,** of Belleville, N. J., under the will of **John H. Eastwood,** who died January 11, at his winter home in Miami, Fla. This stock, representing 1,600 shares of common, gives to Mr. Nealley a controlling interest in the company. Besides the gift of the 1,600 shares, Mr. Nealley is given the option of buying the remainder of Mr. Eastwood's holding in the company at "bargain rates."

The American Brass Company, Waterbury, Conn., on January 1, last, consolidated and renamed several of their branches, as follows: The Benedict and Burnham and Waterbury Brass Plants, located at Waterbury, were consolidated under the name of the "Waterbury Branch"; The Coe Brass Branch, located at Torrington, was renamed the "Torrington Branch." In corresponding with their branches they should be addressed American Brass Company, adding the name of the particular branch. The branches are Ansonia Branch, Ansonia, Conn.; Buffalo Branch, Buffalo, N. Y.; Kenosha Branch, Kenosha, Wis.; Torrington Branch, Torrington, Conn.; Waterbury Branch, Waterbury, Conn.

The stockholders of the **Lumen Bearing Company,** 1155 Sycamore street, Buffalo, N. Y., manufacturers of bronze bearings, etc., have approved an increase in capital from $200,000 to $500,000. The executives of the company are as follows: W. H. Barr president and treasurer; C. H. Bierbaum, vice-president; N. K. B. Patch, secretary; N. F. Young, assistant treasurer; H. P. Parrock, general manager; L. S. Jones, general sales manager. The company also has a plant in operation in Youngstown, Ohio, under the general management of the Buffalo officials, following the same methods that have proved successful at Buffalo. Kester Barr is manager at the Youngstown plant. The combined capacities of these two foundries approaches fifteen million pounds per year. The Youngstown plant was erected for the purpose of taking care of the local steel business.

Announcement is made by **the Sundh Engineering and Machine Company,** of its successful establishment in its new location, 1105 Frankford avenue, Philadelphia, Pa. The Sundh business, which is the manufacture of finishing machinery for brass mills and makers of hot and cold rolled steel strip, originated in the experimental workshop of the well-known inventor, August Sundh. The machines constructed by him for large brass mills in Connecticut and steel mills in the Pittsburgh district proved so successful that a company was incorporated with a capital stock of $100,000, and installed in its own plant at the above address.

The officers are: G. R. Rebmann, president; A. Sundh, vice-president; H. F. Winters, Jr., secretary and treasurer. The latest addition to the staff is Wadsworth Doster, as sales manager, who was for ten years associated with the Torrington Manufacturing Company, Torrington, Conn., makers of brass mill machinery.

Secondary Metal Industry in the United States in 1919

The following advance final figures, compiled by J. P. Dunlop, of the United States Geological Survey, show the quantity and value of certain "secondary metals" recovered in the United States in 1919—that is, the metal recovered from "scrap," the term "primary metal" being applied to that recovered from ore. The total value of such metal recovered was about 33 per cent. less than in 1918. The decrease was due mainly to much lower prices, for, with the exception of antimony, copper, and brass, more metal was recovered in 1919 than in 1918. For comparison, some figures relating to primary metals are also given.

The value of the metals represented in the following tables, which do not include secondary gold, silver, platinum, iron, steel, and ferroalloys, was $181,841,259. It is impossible to estimate the value of scrap iron, steel, and ferroalloys, but it exceeded $200,000,000, and the value of the secondary gold, silver, platinum, and allied metals was $35,646,225:

SECONDARY METALS OF CERTAIN CLASSES RECOVERED IN THE UNITED STATES IN 1918 AND 1919

	1918		1919	
	Quantity (Short Tons)	Value	Quantity (Short Tons)	Value
Copper, including that in alloys other than brass	122,510	$60,519,900	112,400	$41,812,800
Brass scrap remelted	328,800	128,696,300	249,726	75,944,078
Lead as metal	41,146	13,788,200	55,684	12,942,388
Lead in alloys	55,554		66,414	
Zinc as metal	27,108	6,950,600	39,910	6,711,912
Zinc in alloys other than brass and in chemical compounds	11,082		6,062	
Tin as metal	7,142	41,381,000	5,977	29,868,212
Tin in alloys	16,695		18,056	
Antimony as metal	43	1,317,000	48	717,917
Antimony in alloys	5,183		4,351	
Aluminum as metal	6,050	10,113,600	6,017	12,014,575
Aluminum in alloys	9,000		12,674	
Nickel as metal	178	1,532,300	163	1,829,377
Nickel in non-ferrous alloys	1,215		2,284	
	.....	$264,298,900	.....	$181,841,259

COPPER	Short Tons
Copper as metal	83,730
Copper in alloys other than brass	28,670
	112,400
Copper from new scrap	34,000
Copper from old scrap	78,400
	112,400
Brass scrap melted:	
New, clean scrap	143,700
Old scrap	106,000
	249,700
Copper content of brass scrap (averaging about 70 per cent. copper):	
New scrap	100,590
Old scrap	74,200
	174,790

Total secondary copper:	
From new scrap	134,590
From old scrap	152,600
	287,190
Brass scrap imported	7,933
Scrap copper imported	2,109
Brass scrap exported	661
Scrap copper exported	225

LEAD	Short Tons
Secondary lead recovered by smelters that treat mainly ores	12,545
Secondary lead recovered by plants that treat only scrap and drosses	43,139
	55,684
Secondary lead recovered in remelted alloys:	
Lead content of antimonial lead scrap treated at regular lead smelters	2,156
Lead content of drosses and scrap alloys treated at secondary smelters	64,260
Total lead in alloys	66,416
Total secondary lead recovered	122,100
Refined primary lead produced in the United States:	
From domestic ores	424,433
From foreign ore and base bullion	57,787

ZINC	Short Tons
Zinc recovered by redistillation:	
By plants that also treat ores	10,767
By plants that treat only secondary material	8,981
Total redistilled	19,748
Zinc recovered by remelting, sweating, etc	20,162
Total zinc recovered unalloyed	39,910
Zinc recovered in alloys other than brass	6,062
Zinc recovered in brass (estimated)	62,432
Zinc chloride made in 1919, of which 26,250 tons was made from zinc ashes, skimmings, etc	41,500
Zinc content of skimmings and ashes, recovered in chloride	6,500
Lithopone made in 1919, of which 53,000 tons was made from zinc ashes, etc	80,989
Zinc content of zinc ashes and skimmings recovered in lithopone	10,600

TIN	
Tin recovered as pig tin, short tons	5,977
Tin recovered in alloys and chemical compounds, short tons	18,056
	24,033
Clean tin plate scrap treated, including 4,989 long tons imported, long tons	176,451
Old tin-coated containers treated, long tons	6,997
Metallic tin recovered at detinning plants, pounds	2,797,073
Tin content of tin tetrachloride, tin bichloride, and tin oxide made by detinning plants, pounds	3,994,080
Total tin recovered at detinning plants, pounds	6,791,153
Tin tetrachloride, tin bichloride, and tin oxide made at detinning plants, pounds	8,975,576
Average quantity of tin recovered per long ton of old tin-coated containers, pounds	26.09
Average quantity of tin recovered per long ton of clean tin plate scrap, pounds	35.75
Tin imported as metal or oxide in 1919, short tons	44,849
Tin concentrates imported, short tons	19,196
Tin derived from domestic ores in 1919, short tons	56
Percentage of secondary tin recovered to tin imported as metal, in ore, or as oxide	42.3

ALUMINUM	
Secondary aluminum recovered, short tons	6,017
Aluminum recovered in alloys (mainly No. 12) short tons	12,674
	18,691
Value of primary aluminum produced in the United States in 1919	$38,558,000
Aluminum (crude and manufactured) imported for consumption, pounds	13,890,091
Aluminum exported as pig aluminum and manufactured articles, pounds	7,165,782

ANTIMONY	Short Tons
Antimony recovered (mainly in alloys)	4,399
Antimony imported as metal, in ore, or as oxide or salts	7,972
Antimony produced from domestic antimony ores, 1918	127
Antimony produced from domestic antimony ores, 1919	None

NICKEL	Short Tons
Nickel recovered as metal	163
Nickel recovered in alloys and salts	2,284
	2,447
Nickel produced from ore mined in Missouri and as a by-product from the electrolytic refining of copper at domestic refineries	511
Nickel imported for consumption in the United States as nickel, or in nickel ore and matte, oxide and alloys	18,281

AMERICAN BRASS COMPANY STATEMENT

ASSETS

	1919	1920
Real Estate, Machinery and Tools, January 1	$18,199,359.08	$18,512,175.17
Expended for permanent improvements during the year	2,812,816.09	3,408,554.51
	$21,012,175.17	$21,920,729.68
Less charged off for Depreciation	2,500,000.00	2,500,000.00
	$18,512,175.17	$19,420,729.68
Cash	3,469,509.41	1,588,696.19
Bills Receivable	815,593.08	908,284.52
Accounts Receivable	8,458,135.00	6,008,009.48
Wood Lands	252,144.32	224,530.14
Stocks and Bonds owned in other Companies	1,232,766.53	1,243,366.53
Government Bonds owned	4,583,361.56	3,386,828.16
Patents	1,000.00	1,000.00
Merchandise, Raw, Wrought and in Process	12,250,638.95	16,282,668.06
	$49,575,324.02	$49,064,112.76

LIABILITIES

Capital Stock	$15,000,000.00	$15,000,000.00
Accounts Payable	2,698,587.03	632,811.64
Reserve for Contingencies, Taxes, etc.	9,374,524.30	9,374,524.30
Surplus	19,646,072.03	20,702,212.69
	$46,719,183.36	$45,709,548.63
Earnings for the Year	2,856,140.66	3,354,564.13
	$49,575,324.02	$49,064,112.76
Surplus—January 1	$21,446,072.03	$22,502,212.69
Less Dividends Paid	1,800,000.00	1,800,000.00
	$19,646,072.03	$20,702,212.69
Earnings for the Year	2,856,140.66	3,354,564.13
Surplus—December 31	$22,502,212.69	$24,056,776.82

The annual meeting of the stockholders of The American Brass Company was held at its office at Waterbury, Conn., on Tuesday, February 1, 1921, at eleven o'clock a. m., for the purpose of considering the annual report of directors, of electing a board of directors for the ensuing year, and of transacting such other business. Charles F. Brooker was re-elected chairman of the Board, John A. Coe was re-elected president, and John P. Elton remains vice-chairman of the Board and first vice-president.

W. H. BARR SPEAKS ON IMMIGRATION

Addressing the Pittsburgh Chamber of Commerce on January 21, 1921, William H. Barr outlined the immigration policy of The Inter-Racial Council, of which he is president. The chairman of the board is Coleman du Pont and the membership represents more than 1,000 extensive employers of labor and leaders of the racial groups.

Mr. Barr took issue with the opponents of immigration in his usual vigorous fashion. He quoted Government figures and the testimony of experts to prove that the threatened invasion of fifteen or twenty-five million immigrants is a myth. Lack of shipping, high cost of travel and other causes would keep the immigration down to about a million a year, while the number leaving America would reduce it still further.

Mr. Barr advocated an immigration policy based on impartial review of the facts, selection of desirable immigrants and their distribution to points where labor is needed. He reviewed the work of The Inter-Racial Council in the assimilation of the foreign born and declared it a grave mistake to think of foreigners in the mass as "reds" or disturbers.

EXPLOSION IN SMELTING PLANT

One man was blown to bits and three others were hurt, two of them severely, in an explosion January 24, 1921, in the plant of the Columbia Smelting and Refining Company, 365 West street, New York, when a laborer chopped into a piece of loaded lead pipe.

The man who was killed was Luscui Carada, age 42, a laborer, living at 92 Clinton street, Hoboken, N. J. Carada, who leaves a wife and several children, saw four years' service with the Italian Army and came to this country only a few months ago.

The injured were John Supanski, age 32, of 85 Gold street, a foreman, and Kiad Potosky, of 33 Havemeyer street, Brooklyn, both of whom are in St. Vincent's Hospital, and a third man whose hurts were slight.

It was Carada's duty to cut lengths of lead pipe into smaller pieces for smelting. He was chopping up a pile believed to have been bought about a year ago when his axe struck some high explosive. Carada's head was blown from his shoulders, and he was otherwise badly mutilated. The axe was buried in the ceiling and the window glass in the room was shattered. There was no fire and no alarm was sent in.

The members of the Columbia firm are Siegfried, August and Morris Solomon. Their theory is that some of the pieces of pipe came from a munitions plant through a second-hand dealer. Carada, in cutting, probably struck the cement floor and caused a spark which ignited the dried explosive in the pipe. Supanski and Potosky are recovering.

GERMANY BUYS COPPER

Substantial amounts of copper are going direct to Germany. Germany took some copper from this country last year, but most of it went through Rotterdam. The metal is said to be going direct into Germany now through Hamburg. It is paid for in cash, despite the disadvantage in the exchange situation. Credits are impossible of attainment at present. Copper men, however, find encouragement in the outlook, and once an actual peace basis with Germany is declared, it is believed credits for the purchase of copper will be readily obtainable. It is understood that the machinery for obtaining such credits is ready to become operative as soon as peace is concluded.

It is asserted that there has been a steady increase in the amount of copper Germany has been taking. It was predicted by one prominent copper man that Germany might seek copper here at the rate of 10,000,000 to 20,000,000 pounds a month for a considerable time. This would not be as large as in the pre-war years, but Germany was then preparing for a world war, whereas her activities now must perforce be those of peace.

It is considered probable that any eventual extension of credit to Germany for buying copper would be similar to the agreement between the copper export Association and France. This is in the nature of a revolving fund, France receiving the copper, manufacturing it into goods and then paying for the copper. The French banks are sponsor for the payments.

MANHATTAN BRASS ROBBED

Carlos Gunther, 40, of 32 Van Cortland avenue, Yonkers, finished making up the payroll of the Manhattan Brass Company, 332 East Twenty-eighth street, New York, at about 10 o'clock. Armed with the payroll checks, he set out for the Importers and Traders National Bank, Broadway and Murray street. As protection, Richard Schimke, 38, of 428 East Eighty-third street, went along.

On their return three men jumped from a taxicab, waiting at the curb. Two leveled revolvers at the cashier, the third with a quick dart got back of the guard and felled him with one blow. Later a 14-inch monkey wrench, such as used in machine shops, was found.

Gunther, although "covered," endeavored to put up a fight. At his first move one of the men fired once and Gunther fell with a bullet wound two inches above the heart. The robbers took the satchel, climbed into the machine, and were gone. As yet they have not been caught. Gunther is recovering at the Bellevue Hospital. Schimke recuperated at home.

TRADE PUBLICATIONS

Foundry Construction.—A leaflet issued by the Osborn Engineering Company on the modern type of foundry.

Bank and Public Holidays.—A paper bound book issued by the Guaranty Trust Company, New York, giving a complete list of holidays throughout the world.

Concentrating Tables.—A leaflet issued by the Deister Concentrator Company, Ft. Wayne, Ind., illustrating the No. 7 Deister-Overstrom Diagonal Deck Coal Washing Table.

Tube Mill.—A catalog on a new type of mill which uses rollers instead of balls or stones as the crusher medium, called the Marcy roller mill. Issued by the Mine & Smelter Supply Company, New York.

Baush Duralumin.—A catalog issued by the Baush Machine Tool Company, Springfield, Mass., showing the different forms of their Duralumin, its uses, etc., and giving a number of tables of information.

Magnetic Analyzer.—Bulletin No. 41 on the Burrows Defectoscope for inspection of steel rails, rods, wire, cable and all other steel and iron stock of uniform section. Issued by Holz & Company, New York.

Improved Gas Appliances.—A leaflet issued by the Improved Appliances Company, Brooklyn, N. Y., showing their gas burning furnaces, burners and accessories for melting white metals and other materials.

Concrete Houses.—A pamphlet interestingly illustrated with pictures and sketches showing how the Ingersoll-Rand Company is solving its housing problem with concrete. Issued by the Portland Cement Association.

Testing Machine.—Bulletin No. 11 on the Eden-Foster repeated testing machine for investigating the resistance of metals to fatigue produced by repeated impacts of low force. Issued by Holz & Company, Inc., New York.

Refractories for Electric Furnaces.—The collected papers and discussion of the Columbus meeting of the Electric Furnace Association, held October 6, 1920. These can be purchased from H. P. Martin, assistant secretary, Niagara Falls, N. Y., for 50 cents each.

Cooper-Hewitt Quartz Lamp and Ultra Violet Light.—Technical bulletin No. 102, issued by the Engineering Department of the Cooper-Hewitt Electric Company. The bulletin treats the subject briefly, but gives a good bibliography of previous publications. Bulletin No. 86 covers the laboratory outfit.

Electric Wiring.—A bulletin issued by the National Fire Protection Association with its regulations for electric wiring and apparatus. This is frequently referred to as the National Electric Code. The bulletin has been submitted to the American Engineering Standards Committee for approval as an American standard.

Thermit Welding.—A new instruction book, issued by The Metal & Thermit Corporation, New York (No. 41), expressly prepared for use by men actually performing thermit welding railroad repairs. The pamphlet is of convenient pocket size and the instructions have been condensed into the smallest possible space consistent with clearness and thoroughness.

Wires and Cables.—Bulletins 49305-49309, issued by the General Electric Company, on Wires and Cables in General; Conductors Insulated with Vulcanized Rubber Compound; Varnished Cambric and Paper Insulated Cables; Armored Cables; Splicing Materials and Junction Boxes. These bulletins supersede Nos. 49300-49304.

Crain's Market Data Book and Directory of Class, Trade and Technical Papers.—Now on the press. It promises to be of unusual interest to advertisers generally and users of trade and technical papers in particular. It not only lists all of the business publications of the United States and Canada, giving circulations, rates, type page sizes, closing dates, etc., but supplies a market analysis of each trade, profession and industry. Thus the reader is given the basic facts of each line in which he may be interested, including its buying power, buying methods, character of requirements, etc. The volume, which is bound in cloth and contains nearly 500 pages, is published by G. D. Crain, Jr., 417 South Dearborn street, Chicago. The price is $5. Orders in advance of publication are being accepted at the rate of $3.75.

METAL STOCK MARKET QUOTATIONS

	Par	Bid	Asked
Aluminum Company of America	$100	$580	$630
American Brass	100	180	190
American Hardware Corp.	100	135	...
Bristol Brass	25	15	...
International Nickel, com	25	15⅝	15⅞
International Nickel, pfd	100	80	85
International Silver, com	100	25	...
International Silver, pfd	100	84	90
New Jersey Zinc	100	143	148
Rome Brass & Copper	100	135	145
Scovill Mfg. Co.	100	300	340
Yale & Towne Mfg. Co.	...	250	265

Corrected by J. K. Rice, Jr., & Co., 26 Wall Street, New York.

METAL MARKET REVIEW

WRITTEN FOR THE METAL INDUSTRY BY W. T. PARTRIDGE

COPPER

Sales of refined copper in December on domestic and foreign account are estimated to have been between 100,000,000 and 125,000,000 pounds. There was considerable activity during the first half of the month, and during that time prices, which had receded to 12¾c in the major market and to 12½c in the outside market, were subsequently advanced fractionally, but there was more or less irregularity as there was considerable competition among custom smelters who were more concerned with making sales from day to day, irrespective of price, than with cost of production. These producers make their profit on tolls, the cost of getting ore out of the mines being of secondary consideration.

Toward the close of the month, however, there was increased interest shown on foreign account and the tone of the market was firmer at 13c a pound for prompt shipment of electrolytic and 13 to 13¼ for February and March shipment, these prices prevailing in the major as well as in the outside market. Second hands, in fact, had very little metal to offer and there were few sellers at 12¾c f. o. b. refinery for prompt, 12⅞c refinery for February, and 13c refinery for March shipment. These prices are practically the same as those asked by producers, the cost of the delivery being about ¼c pound. Some business was also done for export at 13c f. a. s. N. Y. Early in the month export sales had been made as low as 12½c. As compared with the prices prevailing at the end of 1920, the prices current at the end of January were slightly lower on electrolytic and casting and ¼c to ½c a pound less on lake. Prices had fluctuated within a range of 1c per pound.

TIN

As is usually the case with tin prices, fluctuations were rapid and covered a broad range—6.25c per pound from the highest 39c for Straits Jan. 11, to 32.75c, the lowest, Jan. 25—during the month, rising and falling with varying rates in sterling exchange, upon which tin prices are dependent. After the advanced opening, Straits 35 25c, Banca 36c, American pure 35c and 99% tin 32c, the rise continued daily to the highest levels, Straits 39c, Banca 39.25c, American pure 38.25c and 99% tin 34.50-34.75c. The decline began Jan. 12, continuing daily until Jan. 19, when prices were back to the opening level. After a brief recovery, the decline again held sway, carrying to the lowest levels. In the succeeding two days, there was a recovery of 2.25c per pound, followed by a decline of Straits to 33.50c, Banca 34.50c, American pure 33.25c and 99% tin 29.50c, making a net decline of 1.75c per pound for the month.

With Straits tin under control of the Federated Malay Government at a pegged price of £235, and Banca under control of the Dutch Government, pegged at £236, an interesting situation exists, which however, the American consumer may regard with equanimity in view of the rapidly increasing U. S. reductions of fine tin from Bolivian ores. Of the total deliveries into consumption during 1920, amounting to 65,633 tons, 14,513 tons were from Bolivian ores as compared with 11,596 tons in 1919, and with 3,845 tons in 1916, when such reductions in this country began. Arrivals during January were comparatively light, 1,255 tons being reported on the 28th, of which total 155 tons came into Pacific ports and the remainder into Atlantic ports.

LEAD

Prices of lead in the outside market, including foreign lots, after opening at the December closing level, 4.60-4.70c East St. Louis, 4.62½-4.75c New York, advanced steadily until Jan. 12, when quotations were 4.85-4.90c East St. Louis, 5.15-5.25c New York, the highest levels of the month, which were maintained unchanged until Jan. 18, when a gradual decline, due to falling off in demand, began. The recession was continued, thereafter, until the East St. Louis basis was back to the opening level, 4.60-4.70c, while New York prices were 4.85-4.90c, the net result being nil in the West and an advance of ⅛c per pound New York. From the highest level to the lowest, there was a decline of 30 points New York and 20 points East St. Louis. The American Smelting & Refining Co. made no change in January from its December closing level, 4 75c New York and East St. Louis, alike. An effort to increase the duty on importations of lead is under way, to afford protection to American industry. According to revised estimates of the Geological Survey, total lead production in 1920 was 483,000 tons instead of 511,000 tons as previously announced. This makes the increase over 1919 production about 40,000 tons instead of 68,000 tons.

ZINC

The zinc market did not share in the early January rise in prices of nearly all metals. After opening at the December closing, 5.60c East St. Louis, 6.10c New York, there was a decline of 15 points by Jan. 6, this however, was recovered to the opening level by Jan. 13. Offerings of foreign zinc continued with depressing effect upon prices, which gradually during second fortnight receded to 5.65c New York, 5.15c East St. Louis, making a net decline of thirty points for the month in both the eastern and western markets. In order to check importations of foreign zinc, which for many months past have seriously affected the market in this country, the Zinc Institute has petitioned the Committee on Ways and Means for an increased duty. The Zinc Institute represents over 95% of the zinc industry in the United States.

ALUMINUM

The aluminum market opened at unchanged December closing levels, the producers' schedule remaining unchanged throughout the month, virgin 98-99%, 28.39c; No. 12 alloy 27.50c, and sheet 18 gauge and heavier 42.60c, in 15-ton lots special, subject to daily

conditions. In the outside market, after the opening, there was no change until Jan. 7, when quotations were off 1.00c per pound, virgin 98-99% to 21.22c, remelted 98-99%, 20-21c and No. 12 remelted 19-20c, these prices, the lowest of the month, being quoted until Jan. 13. Following this, there was a gradual advance over the remainder of the month, to virgin 98-99%, 24-25c; remelted 98-99% 22-23c, and No. 12 alloy 20.50-21.50c per pound, making a net advance of 2.00c per pound on virgin, 1.00c on remelted 98-99% and ½c on No. 12 alloy.

As was anticipated, the Aluminum Company of America has asked for an advance in the rate of duty upon importations on the ground of huge surplus existing in Europe which is being disposed of in this country to the detriment of home industry, and made possible by the low rate now in effect. It was further stated in the petition that production in this country during the war was increased to 180,000,000 pounds from 75,000,000 pounds per annum. Domestic consumption during 1919, the year after the war, was only 130,000,000 pounds. A feature of more than ordinary interest was the announcement that the Anaconda Copper Company has turned out its first bar of aluminum at the Washoe reduction works. Arrivals in November were again large, 1,701 tons, making total importations during first eleven months, 1920, 17,089 tons as compared with 7,876 tons received in twelve months, 1919. Exports in November amounted to 137 tons, making total outgo in eleven months 1920, 4,056 tons, as compared with twelve months' outgo in 1919 of 2,235 tons.

ANTIMONY

December closing prices, 5.20c duty paid New York carloads, 5.37½-5.62½c jobbing lots, were carried over unchanged until Jan. 7, when continued heavy stocks and lack of demand brought about a further decline which by Jan. 18 had carried to the lowest level of the month, 5.10c duty paid carloads, 5.25-5.50c jobbing lots. With reports that stocks in the Orient were exhausted and production at a standstill because of prices under the level of cost, prices on Jan. 24 were marked up to 5.50c duty paid carloads. Against this, came Government reports of excessive importations during 1920 and prices receded ⅛c per pound to 5.37½c, making net advance of 17½ points for the month, on duty paid carloads.

SILVER

The price of bar silver of foreign origin, Jan. 3, opened the year at an advance of 1½c to 65¾c per ounce. After a sharp and continuous rise to the highest level 68⅝c Jan. 6, fluctuations carried to the lowest 64½c, quoted Jan. 28, this being ¼c per pound above the December closing. Purchases of silver by the United States Government at the pegged price 99½c, for bar, $1.00 for fine—under the Pittman Act, in January, amounted to 691,000 ounces, bringing the total amount purchased on this movement to 30,023,639 ounces. Silver output in 1920, according to preliminary statistics of the Geological Survey, were 56,504,504 ounces valued at $57,420,325.

QUICKSILVER

In sympathy with the early January advance in prices of many metals, quicksilver, after being quoted at the December closing $45 per flask until Jan. 13, was on that day, marked up $5 per flask to $50, this being the quotation over the remainder of the month. Producers in the West, claiming that the metal is being dumped from foreign markets into this country, have asked for a specific duty of 50c per pound instead of the 10 per cent ad valorem that exists at present. Quicksilver abroad is produced at such a low cost as to make competition from the American producer impossible.

PLATINUM

Platinum declined $2.50 per troy ounce in January from the December closing $75 to $72.50 per oz. on Jan. 20, remaining unchanged thereafter, to time of going to press. While this price is below the lowest level of any month since 1917, it is $10 per ounce above the lowest, $62.50, in August, 1916. The yearly average price of platinum in the period 1910-1915 inclusive, advanced gradually from $32.70 in 1910, to $47.13 in 1915.

OLD METALS

It was confidently asserted toward the close of January that improvement in the movement of scrap metals was under way. Orders, while not large in volume, were more frequent and in some cases, urgency was so great as to demand express shipments, indicating the extent to which stocks have been depleted. Prices on some items, after sagging early in the month, were slightly advanced. The coppers were up ½c to 8.5c light copper, 11c strictly crucibled, while uncrucibled was unchanged at 9.50c. Aluminums, however, showed a further net decline, being off ½c to 6.50c for clean turnings and borings, 2c each to 12c and 10c respectively, for clippings and old sheet, and 1½c to 9.50c for old cast. No. 1 pewter was up 2c to 18c, heavy lead ¼c to 3.75c, and tea lead ½c to 2.50c. New zinc scrap was off ¼c to 3.75c, old zinc was unchanged. Electrotype was up ½c to 3.75c and No. 1 brass, an equal amount to 5.50c. Red car boxes were down ¼c to 8.00c, while stereotype was unchanged and battery lead was up ¼c to 1.75c.

WATERBURY AVERAGE

Lake Copper. Average for 1920, 18.06. 1921—January, 13.75.
Brass Mill Zinc. Average for 1920, 8.33. 1921—January, 6.05.

JANUARY MOVEMENT IN METALS

	Highest	Lowest	Average
Copper:			
Lake	14.00	13.00	13.536
Electrolytic	13.25	12.50	12.851
Casting	12.75	12.37½	12.61
Tin	39.00	32.75	36.113
Lead	5.37½	4.62½	5.114
Zinc (brass special)	5.75	5.20	5.581
Antimony	5.50	5.10	5.218
Aluminum	25.00	21.00	22.859
Quicksilver (per flask.)	50.00	45.00	48.095
Silver (cts. per oz.) Foreign	68.62½	59.875	65.95

Metal Prices, February 1, 1921

NEW METALS

Open Market

	Cents
COPPER—DUTY FREE. PLATE, BAR, INGOT AND OLD COPPER. Manufactured 5 per centum.	
Electrolytic, carload lots, delivered	12¾
Lake, carload lots, delivered	13¼
Casting, carload lots, delivered	12⅝
TIN—Duty free.	
Straits of Australian, carload lots	34
LEAD—Duty, Pig, Bars and Old, 25%; pipe and sheets, 20%. Pig lead, carload lots	4.75–4.85
ZINC—Duty 15%.	
Brass Special	5.75
Prime Western, carload lots	5.60
ALUMINUM—Duty, Crude, 2c. per lb. Bales, sheets, bars and rods, 3½c. per lb.	
Small lots, f. o. b. factory	....
100-lb., f. o. b. factory	....
Ton lots, f. o. b. factory	24–28
ANTIMONY—Duty 10%.	
Cookson's, Hallet's or American	Nominal
Chinese, Japanese, Wah Chang WCC, brand spot	5.25
NICKEL—Duty, Ingot, 10% ad valorem. Sheet, strip, strip and wire, 20%.	
Ingot	43.00
Shot	43.00
Electrolytic	45.00
MANGANESE METAL	Nominal
MAGNESIUM METAL—Duty 20% ad valorem (100 lb. lots)	$1.60–$1.75
BISMUTH—Duty free	2.40– 2.42
CADMIUM—Duty free	$1.40
CHROMIUM METAL—Duty free	Nominal
COBALT—97% pure	Nominal $4.50
QUICKSILVER—Duty 10% per flask of 75 pounds	50.00
PLATINUM—Duty free, per ounce	70.00
SILVER—Government assay—Duty free, per ounce	.99½
GOLD—Duty free, per ounce	$20.67

Metal Prices, February 1, 1921

INGOT METALS

Silicon Copper, 10%	according	to	quantity	49	to55
Silicon Copper, 20%	"	"	"	36	to40
Phosphor Copper, guaranteed 15%	"	"	"	25	to35
Phosphor Copper, guaranteed 10%	"	"	"	24	to34
Manganese Copper, 30%	"	"	"	50	to56
Phosphor Tin, guarantee 5%	"	"	"	40	to50
Phosphor Tin, no guarantee	"	"	"	43	to53
Brass Ingot, Yellow	"	"	"	9½	to10½
Brass Ingot, Red	"	"	"	12¾	to14½
Bronze Ingot	"	"	"	15½	to17½
Parsons Manganese Bronze Ingots	"	"	"	17½	to19
Manganese Bronze Castings	"	"	"	36	to39
Manganese Bronze Ingots	"	"	"	14	to17
Manganese Bronze Forgings	"	"	"	30	to40
Phosphor Bronze	"	"	"	24	to30
Casting Aluminum Alloys	"	"	"	27	to29
Monel Metal	"	"	"	38	to..

OLD METALS

Buying Prices		Selling Prices
10 to10¼	Heavy Cut Copper	11½to12½
9 to 9½	Copper Wire	10½to11½
8 to 8½	Light Copper	9½to10
10 to10½	Heavy Machine Comp.	12 to12½
6½to 7	Heavy Brass	8½to 9
4½to 5	Light Brass	6½to 7
5½to 6	No. 1 Yellow Brass Turnings	7 to 7½
9 to 9½	No. 1 Comp. Turnings	10½to11
4	Heavy Lead	4½
4	Zinc Scrap	4½
7 to10	Scrap Aluminum Turnings	8 to11
16 to18	Scrap Aluminum, cast alloyed	18.50to20.00
19.00	Scrap Aluminum, sheet (new)	21½
26.00	No. 1 Pewter	30.00
15.00	Old Nickel anodes	17.00
23 to25	Old Nickel	27 to29

BRASS MATERIAL—MILL SHIPMENTS

In effect January 10, 1921.

To customers who buy 5,000 lbs. or more in one order.

	Net base per lb.		
	High Brass.	Low Brass	Bronze.
Sheet	$0.18¾	$0.20½	$0.22
Wire	.19¾	.21½	.23
Rod	.16¾	.21½	.23
Brazed tubing	.32½	..	.37¼
Open seam tubing	.32½	..	.37¼
Angles and channels	.37½	..	.42¼

To customers who buy less than 5,000 lbs. in one order.

	Net base per lb.		
	High Brass.	Low Brass.	Bronze.
Sheet	$0.20	$0.21¾	$0.23¾
Wire	.21	.22¾	.24¼
Rod	.18	.22¾	.24¼
Brazed tubing	.33¾	..	.38½
Open seam tubing	.33¾	..	.38½
Angles and channels	.38¾	..	.43½

SEAMLESS TUBING

Brass, 23½c. to 25c. per lb. base.
Copper, 24½c. to 26c. per lb. base.

TOBIN BRONZE AND MUNTZ METAL

Tobin Bronze Rod	21¼c. net base
Muntz or Yellow Metal Sheathing (14"x48")	18¾c. " "
Muntz or Yellow Rectangular Sheets other than Sheathing	19¾c. " "
Muntz or Yellow Metal Rod	16¾c. " "

Above are for 100 lbs. or more in one order.

COPPER SHEET

Mill shipments (hot rolled)	21¼c.-22½c. net base
From stock	23¼c.-27¼c. net base

BARE COPPER WIRE—CARLOAD LOTS

15¾c. to 16¾c. per lb. base.

SOLDERING COPPERS

300 lbs. and over in one order	24c. per lb. base
100 lbs. to 300 lbs. in one order	25c. per lb. base

ZINC SHEET

Duty, sheet, 15%. Cents per lb.

Carload lots, standard sizes and gauges, at mill, 11½c. basis less 8 per cent. discount.

Casks, jobbers' prices	13½c.
Open casks, jobbers' prices	14c.

ALUMINUM SHEET AND COIL

Aluminum sheet coils, base price, 42.60c, 18 ga. and heavier, 42.60c per lb.; 24 ga. and heavier, 46.60c per lb.

NICKEL SILVER (NICKELENE)

Base Prices

Grade "A" Nickel Silver Sheet Metal

10% Quality	32c	per lb.
15% "	34¼	" "
18% "	35¼	" "

Nickel Silver Wire and Rod

10% Quality	33¾c	per lb.
15% "	38	" "
18% "	40¾	" "

MONEL METAL

Shot	35
Blocks	35
Sheet Bars	40
Hot Rolled Rods (base)	42
Cold Drawn Rods (base)	56
Hot Rolled Sheets (base)	55

BLOCK TIN SHEET AND BRITANNIA METAL

Block Tin Sheet—18" wide or less. No. 26 B. & S. Gauge or thicker, 100 lbs. or more, 10c. over Pig Tin. 40 to 100 lbs., 15c., over 25 to 50 lbs., 17c. over, less than 25 lbs., 25c. over.

No. 1 Britannia—18" wide or less. No. 26 B. & S. Gauge or thicker, 500 lbs. or over, 8c. over N. Y. tin price; 100 lbs. or more, 10c. over Pig Tin. 50 to 100 lbs., 15c. over, 25 to 50 lbs., 20c. over, less than 25 lbs., 25. over. Above prices f. o. b. mill.

Lead Foil—base price—figured on base price of lead at the time.

Platers' metal, so called, is very thin metal not made by the larger mills and for which prices are quoted on application to the manufacturer.

SILVER SHEET

Rolled silver anodes .999 fine are quoted at from 66½c. to 68½c. per Troy ounce, depending upon quantity.

Rolled sterling silver, 64½c. to 67½c.

NICKEL ANODES

85 to 87% purity	.55c.	per lb.
90 to 92% "	.57½c.	per lb.
95 to 97% "	.60c.	per lb.

Supply Prices, February 1, 1921

CHEMICALS

Acid--		
Boric (Boracic) Crystals	lb.	.20
Hydrochloric (Muriatic) Tech., 20 deg., Carboys	lb.	.05
Hydrochloric, C. P., 20 deg., Carboys	lb.	.10
Hydrofluoric, 30%, bbls	lb.	.10
Nitric, 36 deg. Carboys	100 lb.	8.28
Nitric, 42 deg. Carboys	100 lb.	8.90
Sulphuric, 66 deg., Carboys	lb.	.04½
Alcohol—		
Denatured	gal.	1.25
Alum—		
Lump, Barrels	lb.	.07
Powdered, Barrels	lb.	.08
Aluminum sulphate, commercial tech	lb.	.06
Aluminum chloride solution	lb.	.30
Ammonium—		
Sulphate, tech., Barrels	lb.	.08½
Sulphocyanide	lb.	1.50
Argols, white, see Cream of Tartar	lb.	.80
Arsenic, white, Kegs	lb.	.18
Asphaltum	lb.	.35
Benzol, pure	gal.	.75
Blue Vitriol, see Copper Sulphate.		
Calcium Carbonate (Precipitated Chalk)	lb.	.20
Borax Crystals (Sodium Biborate), Barrels	lb.	.10½
Carbon Bisulphide, Drums	lb.	.12
Chrome Green	lb.	1.15
Cobalt Chloride	lb.	—
Copper—		
Acetate	lb.	.60
Carbonate, Barrels	lb.	.29
Cyanide	lb.	.63
Sulphate, Barrels	lb.	.07½
Copperas (Iron Sulphate, bbl.)	lb.	.03
Corrosive Sublimate, see Mercury Bichloride.		
Cream of Tartar, Crystals (Potassium bitartrate)	lb.	.80
Crocus	lb.	.15
Dextrin	lb.	.25
Emery Flour	lb.	.10
Flint, powdered	ton	—
Fluor-spar (Calcic fluoride)	ton	—
Fusel Oil	gal.	6.50
Gold Chloride	oz.	14.00
Gum—		
Sandarac	lb.	—
Shellac	lb.	—
Iron, Sulphate, see Copperas, bbl	lb.	.03
Lead Acetate (Sugar of Lead)	lb.	.35
Yellow Oxide (Litharge)	lb.	.25
Mercury Bichloride (Corrosive Sublimate)	lb.	1.48
Nickel—		
Carbonate Dry	lb.	.55
Chloride, 100 lb. lots	lb.	.50
Salts, single, bbls	lb.	.16
Salts, double, bbl	lb.	.15
Paraffin	lb.	.30
Phosphorus—Duty free, according to quantity		.32-.38
Potash, Caustic, Electrolytic 88-92% fused	lb.	.32
Electrolytic 70-75% fused	lb.	.26
Potassium Bichromate, Casks	lb.	.17
Carbonate, 80-85%	lb.	.23
Cyanide, 98-99½%, 100 lb. cases	lb.	.60
Pumice, ground, bbls	lb.	.05
Quartz, powdered	ton	—
Official	oz.	—
Rosin, bbls	lb.	.07
Rouge, nickel, 100 lb. lots	lb.	.40
Silver and Gold	lb.	.60
Sal Ammoniac (Ammonium Chloride) in casks	lb.	.13
Silver Chloride, dry	oz.	1.20
Cyanide	oz.	—
Nitrate, 100 ounce lots	oz.	.53¾
Soda Ash, 58%, bbls	lb.	.03½
Sodium—		
Biborate, see Borax, bbls	lb.	.10½
Bisulphite, tech. bbls	lb.	.09
Cyanide, 96 to 98%, 100 lbs	lb.	.30
Hydrate (Caustic Soda) bbls	lb.	.05½
Hyposulphite, kegs	lb.	.06
Nitrate, tech., bbls	lb.	.07
Phosphate, tech., bbls	lb.	.06
Silicate (Water Glass) bbls	lb.	.03
Sulpho Cyanide	lb.	.90
Soot, Calcined	lb.	—
Sugar of Lead, see Lead Acetate	lb.	.35
Sulphur (Brimstone) bbls	lb.	.04
Tin Chloride	lb.	.40
Tripoli	lb.	.03½
Verdigris, see Copper Acetate	lb.	.60
Water Glass, see Sodium Silicate, bbls	lb.	.03
Wax—		
Bees, white ref. bleached	lb.	1.00
Yellow No. 1	lb.	.60
Whiting, Bolted	lb.	.10
Zinc, Carbonate, bbls	lb.	.26
Chloride, 600 lb. lots	lb.	.13½
Cyanide	lb.	.46
Sulphate, bbls.	lb.	.04

COTTON BUFFS

Open buffs, per 100 sections (nominal).		
12 inch, 20 ply, 64/68, cloth	base,	$39.05
14 " 20 " 64/68, "	"	48.65
12 " 20 " 84/92, "	"	45.85
14 " 20 " 84/92, "	"	61.75
Sewed buffs, per pound		
Bleached and unbleached	"	.75

FELT WHEELS

				Price Per Lb.
White Spanish—				
Diameter— 8" to over 16"		Thickness—½" and ¾"	..	$4.00
" 8"		" 1" to 3"	...	3.10
" 10" to 16"		" 1" to 3"	...	3.00
" over 16"		" 1" to 3"	...	3.10
" 8" to over 16"		" over 3"	...	3.40
Grey Mexican—				
Diameter— 8" to over 16"		Thickness—½" and ¾"	..	$3.90
" 8"		" 1" to 3"	...	3.00
" 10" to 16"		" 1" to 3"	...	2.90
" over 16"		" 1" to 3"	...	3.00
" 8" to over 16"		" over 3"	...	3.30

Above are even diameters. Odd diameters 50c advance.